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PURIFICATION AND PRECIPITATION OF THE ERYTHROGENIC FACTOR OF SCARLET FEVER STREPTOCOCCUS TOXIN AND ITS ANTIGENIC VALUE

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The purpose of this report is to present a method of purifying and precipitating the erythrogenic toxin of the hemolytic streptococcus for use in active immunization against scarlet fever. Such a modification greatly reduces the amount of nitrogen-containing compounds present in the immunizing material either as constituents of the broth or as bacterial proteins elaborated by the growing bacteria, apart from the erythrogenic toxin itself. At the same time, the method prepares the toxin in an insoluble form which gives it the antigenic advantage of slower absorption when injected for purposes of producing active immunity. Clinical data are also presented which indicate that such a preparation is tolerated in larger doses than is the case with the unpurified soluble toxin, and that a small total dose is required to bring about a negative Dick test in a satisfactory percentage of the susceptible individuals treated.

Ando, Kurauchi, and Nishimura (*1*) showed that the crude hemolytic streptococcus broth filtrate contained two substances capable of invoking skin reactions: (*a*) A substance which is alcohol-insoluble and relatively heat-labile, and (*b*) a substance which is both alcohol and acetic acid insoluble and which is heat-stabile. From clinical data which these authors (and also Toyoda and Futagi (*2*)) present, they conclude that the acetic acid insoluble fraction is identical with the nucleoprotein obtained by extraction of the washed bacteria themselves, and that the skin reaction resulting from the injection of this fraction is a manifestation of sensitization to this bacterial protein without relation to susceptibility to scarlet fever. Conversely, they conclude that the alcohol insoluble fraction contains the true erythrogenic toxin of scarlet fever and skin reactions produced by injections of this fraction indicate susceptibility to scarlet fever, this latter substance being the essential fraction contained in the Dick test toxin.

Green (*3*) modified somewhat the above method of collecting the alcohol-insoluble fraction so as to obtain a higher yield of the essential

toxin. He found this fraction "completely inactivated by heating for 30 minutes at 100° C.", and that boiling for 3 hours was required to destroy the acid insoluble fraction in the dilutions used. This investigator also concludes that the alcohol-insoluble fraction represents the true erythrogenic toxin of scarlet fever, and that the acid-insoluble fraction "appeared to be identical with a similar acid-insoluble fraction derived from an alkaline extract of washed bacterial bodies."

The findings to which reference has just been made have been confirmed by a parallel study carried out by the writer of this report. These two fractions invariably are present in the crude toxin. The alcohol-insoluble, heat-labile fraction invokes the Dick test reaction of susceptibility to scarlet fever, combines readily with antitoxin, and produces the symptoms of scarlet fever (except the sore throat) when injected in a sufficiently large dose in a Dick-positive child. On the other hand, the acid-insoluble, heat-stabile fraction invokes skin reactions more frequently in adults (where scarlet fever susceptibility is less common), possesses no combining power with antitoxin, and produces both local and constitutional reactions (but which are not typical of scarlet fever) when injected in sufficiently large doses, particularly in an adult.

The coexistence of these two fractions in the crude toxin should cause no surprise in view of our more extensive knowledge of the reactions induced by diphtheria toxin where an exactly parallel situation appears to exist. Susceptibility to the true toxin in either disease occurs when the titer of circulating antitoxin falls sufficiently low, whereas reaction to the heat-stabile bacterial protein is dependent upon sensitization to this protein brought about by actual contact with specific protein. Hence, we find that disease susceptibility (as measured by the Dick or Schick tests) decreases with age and extent of exposure, whereas sensitivity to the nucleoprotein increases with age and extent of exposure. Not infrequently reaction to both factors exists in the same individual. How often and to what degree this hemolytic streptococcus allergic state exists in the general population is shown by Myers, Keefer, and Oppel (*4*), Menten, King, Briant, and Graham (*5*), Derrick and Fulton (*6*), Gibson and McGibbon (*7*), Lyttle, Seegal, and Jost (*8*), Zingher (*9*), and Ando, Kurauchi, and Nishimura (*1*).

METHODS

Purification of the erythrogenic toxin.—The Dochez NY–5 strain of hemolytic streptococcus has been used in this study because of its uniformly high toxin production and also because of its good antigenic properties as indicated by the results obtained in preparing antitoxin for therapeutic use. However, a considerable number of other strains

have been studied, and the method has been found equally applicable irrespective of the disease of origin of the particular strain. In principle, the method to be described is the same as that used by Ando, Kurauchi, and Nishimura (*1*) and the modification devised by Green (*3*). Certain changes have been made by the writer which seem to simplify the method and improve the yield.

A toxin of high potency is desirable. This may be obtained by culturing the hemolytic streptococcus in three-quarter strength Douglas tryptic digest broth with an initial pH of 7.4 and a meat base of either veal or human placenta. After the broth is sterilized, 0.75 percent of dextrose (in the form of a sterile 50-percent solution) and 0.3 percent of a 0.25-percent alcoholic solution of phenol red are added. The completed medium is now incubated for sterility, and at the proper time the warm broth is inoculated with a young, rapidly growing culture and incubated at 37° C. until growth ceases. Growth is prolonged by carefully maintaining a pH of 7.0–7.2 through the addition of 15 percent NaOH solution as frequently as the color change of the phenol red indicates a pH of 7.0 or lower. (The addition of the alkali is facilitated by providing the culture flask with a two-hole stopper, one hole being fitted with a bent, cotton-stoppered vent tube and the other with a straight glass tube through which the alkali may be added. This latter tube is protected with an inverted small test tube, and the entire top of the flask is protected with a paper cone.) The culture flask should be vigorously rotated while the alkali is being added in order to insure rapid mixing. During the period of greatest growth the pH may need to be adjusted as often as every 10 to 15 minutes. When growth has ceased, the culture is tested for purity, the toxin broth is filtered free from bacteria, 0.4 percent phenol is added, the pH is adjusted to 7.0 and, finally, the toxin is stored at 0–5° C. for aging before titrating its potency. This method should produce a toxin having a potency of approximately 150,000 STD per cc, provided a suitable strain is used.

The purification of the toxin is accomplished as follows: To 3.5 volumes of 95 percent ethyl alcohol, cooled to 0° C. or lower, add 1 volume of toxin which has been cooled to 0–5° C., shake immediately and vigorously for about 1 minute, and then quickly collect the precipitate by centrifugation. Redissolve the moist precipitate in not more than one-fourth volume of normal saline and add 2 percent of glacial acetic acid. Mix and store at 0–5° C. overnight. Remove and discard the precipitate (nucleoprotein-containing fraction) by centrifugation. Dilute the supernatant liquid to one-half volume with buffered, phenolized saline as is recommended by the Scarlet Fever Committee for the dilution of the test toxin (1 part of phosphate buffer, pH 7.0, 9 parts of 0.85 percent NaCl, and 0.4 percent phenol). Finally, filter through a Berkefeld candle and store at 0–5° C. If this

purified toxin is to be used soon for the preparation of precipitated toxin as described below, the pH need not be adjusted at this stage. However, if the toxin is to be kept for any length of time, it is advisable to adjust the pH to 7.0 during the process of bringing up to the one-half volume.

Should a toxin of greater purity be desired, the alcohol and acetic acid precipitation step may be repeated. A purification involving two alcohol and one acetic acid precipitation will retain about 60 percent of its original potency, with the elimination of approximately 90 percent of the total nitrogen as is indicated in the following table:

Designation of toxin	Total nitrogen per 100 cc		Percent of total nitrogen removed
	Raw toxin	Purified toxin	
HL-43	206.7	28.4	86.3
179	150.4	11.2	92.6
337-H-14	167.9	10.8	93.8
337-H-14	167.9	8.2	95.1
028251	330.3	37.7	88.6
42646	198.0	13.9	93.0

The preparation of precipitated erythrogenic toxin.—Potassium alum does not precipitate the toxin. Trials with various protein precipitants disclosed the fact that tannic acid forms a stabile, insoluble, and noncorrosive compound with the toxin. For this purpose a 0.5 percent concentration of tannic acid in the toxin of pH 6.0 or less precipitates essentially 100 percent of the erythrogenic toxin and only about 40 percent of the total nitrogen contained in the crude toxin. With purified toxin 0.5 percent tannic acid precipitates all of the total nitrogen. The precipitate forms as large, whitish-gray floccules which slowly settle out. This precipitate is apparently inert from the standpoint of producing tissue necrosis. One cc of a fourfold concentration of the precipitated toxin when injected subcutaneously into the abdominal wall of guinea pigs produced a well localized induration which persisted for nearly 3 weeks, but at no time was there any evidence of tissue destruction. Up to the present time over 4,000 children have received either subcutaneous or intradermal immunizing doses of precipitated antigen without any evidence of local abscess formation.

Such a washed precipitate remains as a loose flocculent mass when resuspended in its original volume and kept at 0–5° C., but when stored at room temperature, or when it was shipped across the continent, and return, in summer, it contracted into a firm, dark-colored mass which could not be resuspended by shaking. However, it was found that the addition of a colloid would prevent such clumping. Acacia has been used for this purpose, since neither its presence in the immunizing

toxin suspension interferes with the antigenic value nor does the small amount used possess any objectionable features for parenteral use in the human.

The various steps in preparing this precipitated toxin are as follows: Dilute one volume of toxin, previously cooled to 0–5° C., with three volumes of cool, phenolized buffered saline solution of pH 6.0 (9 parts 0.85 percent saline, one part phosphate buffer pH 6.0, and 0.4 percent phenol), and add slowly to this diluted toxin 0.5 percent tannic acid (0.5 percent of the original volume of toxin) which has previously been dissolved in one volume of buffered saline. Shake vigorously during the mixing process and for a short time thereafter. Allow to stand at 0–5° C. until the precipitate has settled out, usually overnight. Draw off the supernatant liquid and replace with an equal volume of fresh buffered saline. Mix thoroughly and again allow the precipitate to settle out. The washing is repeated until all color of the original toxin has disappeared and the filtered wash water no longer gives a test for tannic acid with ferric chloride test solution. Usually three washings suffice.

Finally, all possible supernatant liquid is drawn off, sufficient 10 percent acacia solution is added to give a 1-percent concentration in the final volume, and enough buffered saline is added to bring up to the original volume. It is needless to add that the sterility of the toxin must be preserved throughout the entire process. This now represents the purified and precipitated toxin from which further dilutions are made for immunization purposes.

Preparation of the individual immunizing doses.—The dilution of this stock suspension of purified and precipitated toxin into suitable immunizing doses depends upon the potency of the stock suspension, the desired final dose, and its volume. The dilution formula is as follows:

A. Stock suspension of toxin.
B. Sterile acacia solution (10 percent) enough to give a 1-percent solution.
C. Sterile saline-phosphate buffer solution of pH 7.0 (the formula is given above under toxin purification).

As a result of the trial immunizations which are to be described later, the intradermal method of injecting the antigen seems preferable, and in 3 doses of 750, 3,000, and 10,000 skin-test doses, respectively. The volume of each intradermal dose is 0.1 cc, and therefore the stock suspension is diluted by the above formula into 3 doses of 7,500, 30,000 and 100,000 skin-test doses per cubic centimeter, respectively. From this it will be seen that the stock suspension must contain at least 100,000 STD per cubic centimeter. An interval of 2 weeks is allowed between injections. There is some evidence to indicate that a longer interval will produce a higher percent of immunes.

The preferred site for making the intradermal injection is on the outer surface of the lower half of the upper arm.

Active immunization with purified and precipitated toxin.—Intramuscular, subcutaneous, and intradermal injections were made in different groups of children in order to determine the method of preference with regard to (*a*) local and constitutional reactions, and (*b*) the immunity response as measured by the Dick test at some later date.

It soon became evident that the child very definitely showed a preference for the intradermal method. In the child's mind, immunization by this method merely means another skin test. (There is available a 26-gage needle, three-sixteenths of an inch in length and with one side of the hub beveled so that the needle shaft will be flat on the skin.) Intradermal injections can be made quickly, with little preparation and equipment, and it is easy to maintain aseptic technique. Intramuscular injections invariably cause muscle soreness of some degree. The intradermal injection causes a clearly circumscribed area of induration which lies superficially without involvement of the muscle. This eliminates muscle soreness on motion, a very important factor in the active child. There may be localized tenderness on palpation. An occasional child, usually an older one, may develop more extensive local swelling. There is a wide individual variation in the maximum dose which is tolerated without significant reaction, irrespective of the route selected for making the injection, and there is also a rather constant age factor, reactions increasing with age. The underlying cause for these differences in tolerance is not clear, but it is the writer's opinion that previous sensitization to the specific bacterial protein plays a very great role both in individual and age variations.

Trial doses which have involved injections in a total of 3,208 persons (nearly all of grammar-school age) have been given in a study to determine the practicability of this purified and precipitated toxin. An initial intradermal dose of 750 skin-test doses and a second dose of 3,000 skin-test doses causes essentially no significant reaction. A third dose of 10,000 skin-test doses in a group of 871 caused vomiting in less than 5 percent. This vomiting was rather peculiar in that it so frequently occurred within a few hours of the injection and was so quickly followed by complete relief. Other constitutional symptoms were insignificant in the 871 children. Local reactions following either of the three injections were not important.

The same doses given as subcutaneous or intramuscular injections may be expected to cause constitutional reactions more frequently and always more local discomfort.

Another indication of the very little discomfort experienced by the child from three injections of 750, 3,000, and 10,000 skin-test doses, respectively, is that in a group of 1,203 grammar-school children,

scattered through 17 schools, only 5 (or 0.4 percent) refused to complete the course of treatment and the retest.

TABLE 1.—*Active immunization of Dick-positive children of grammar school age with subcutaneous or intramuscular injections of purified and precipitated scarlet fever streptococcus toxin*

Group	Total skin test doses of toxin injected	Results of retesting with standard control toxin [1]		
		Number retested	Negative	Percent negative
A	[2] 5,000	37	26	72.2
B	[3] 10,500	64	50	78.1
C	[2] 21,000	37	34	91.9
D	[3] 25,000	360	332	92.2

[1] Retests made 1 to 2 months after the last immunizing injection.
[2] Given in 2 graduated doses with a 2-week interval.
[3] Given in 3 graduated doses with 2-week intervals.

The immunity produced by the subcutaneous and intramuscular injections of the purified and precipitated toxin is shown in table 1. Group B received 500, 2,000, and 8,000 STD, respectively, as the three injections and without significant reaction. Group D received 1,000, 4,000, and 20,000 STD, respectively. However, local and constitutional reactions were too frequent with the latter dosage, even though the percentage of immunes is satisfactory.

Table 2 gives the immunity results following intradermal injections of two or three doses. It will be seen from the retest results that a satisfactory percentage of immunes may be obtained with either two or three intradermal injections. However, when the resultant reactions are considered, the larger doses given in the two-dose method are unsatisfactory because of the frequency of constitutional reactions (about 20 percent).

TABLE 2.—*Active immunization of Dick-positive persons with intradermal injection of purified and precipitated scarlet fever streptococcus toxin*

Group	Age range of persons treated	Total skin test doses of toxin injected [1]	Results of retest		
			Number	Negative	Percent negative
A	6–13 years	4,000–5,000	172	96	55.8
B	do	6,000–9,000	439	362	82.4
C	do	13,750–16,000	1,008	842	83.5
D	Preschool	8,000	19	17	----------
E	High-school students and pupil nurses	16,000–19,000	47	42	----------

[1] An interval of 2 weeks was allowed between doses in groups A, C, and E. The interval was 5 weeks in groups B and D. Groups A, B, and D received 2 doses; groups C and E, 3 doses. The volume of each injection was always 0.1 cc, and the injection was made on the outer surface and lower half of the upper arm.

The practice has been not to retest the treated children sooner than 1 month after the last immunizing injection. As a general rule, it may be said that the longer the interval between immunization

and the retest the more rigid the measure of the antigenic value of the method used.

Sera from three boys whose Dick reaction had been rendered negative by two intradermal injections were titrated against controls consisting of three sera from boys with "natural" Dick negative reactions. Each of the six neutralized more than 20 skin-test doses of standard toxin per cubic centimeter. Unfortunately, the titrations were not carried to an end point.

Insufficient time has elapsed to give great significance to any change in the incidence of scarlet fever within the age group studied. Nevertheless, the trend is very definitely to a grouping of the reported cases in that age group of the population not included in the study group (namely, the first six grades of grammar school). For example, based on a 6-year average, 55.8 percent of all the cases reported occurred within the age range of 6 to 12 years, both inclusive, whereas since immunization started this percentage has fallen to 31.7 percent with no case occurring in a treated child. In one community having 300 children in the first six grades of grammar school, active immunization with two doses was started in the midst of an outbreak, which to date has totaled 32 cases. Six months have elapsed since the first injection, with no case in a treated child, as against 13 cases in persons neither tested nor treated. A detailed epidemiological report will be made at a later date covering the entire study group.

DISCUSSION

As a result of this study, which was begun in May 1935, there has been developed a practicable method of preparing the hemolytic streptococcus toxin in the form of a purified and insoluble antigen. The modification outlined in Appendix A greatly simplifies the earlier method used in the major portion of this study.

Using human placenta as the source of the essential broth proteins in place of veal or beef eliminates from the toxin foreign proteins to which some humans are sensitized. Inclusion of the acetic acid precipitation step removes most of the undesirable heat-stabile protein fraction without causing any appreciable reduction in the amount of erythrogenic toxin present. The insolubility of the finished product retards absorption and thereby lengthens the period of antigenic stimulation. The intradermal route of making the injections in itself retards absorption and also greatly reduces local pain and muscle soreness.

The injection of 3 intradermal doses of 750, 3,000, and 10,000 skin test doses, respectively, changed the Dick reaction from positive to negative in over 80 percent of the children treated. It was observed that the percentage becoming negative varied somewhat with the economic status of the family and with the incidence of endemic scarlet

fever in the community. There is also an age variation, younger children, on the average, being slightly more difficult to immunize.

The three injection-intradermal method was well received by both child and parent. In the present study 9,379 children were given consent slips; and of these, 6,005, or 64.03 percent, were returned with parental approval. Of the 6,005 children given the preliminary Dick test, 44.06 percent were positive; and of these, less than 0.5 percent refused to complete the course of three injections and a retest. The writer feels that some consideration must be given to the viewpoint of the child, parent, family physician, and health officer, and to the importance of the disease itself, in devising methods of active immunization. Experience has shown that the production of complete group immunity against any disease is impracticable. However, if in the case of scarlet fever it is desirable to produce more immunes than is accomplished by the three-injection method used in this study, it can readily be done by one of three methods: (*a*) By giving a fourth injection to those who give a positive reaction on retest; (*b*) by increasing the number of skin test doses in the third dose (in one group studied 95 percent tolerated a third dose of 12,000 STD without significant constitutional symptoms, and approximately 85 percent tolerated 20,000 STD); or (*c*) the routine administration of more than three doses to all Dick positive children. Of these three alternatives, the first would be preferred by both child and parent, and offers the least administrative inconvenience.

Because of the very high percentage of preschool and first-grade children who are Dick positive, and because of the occurrence of more than half of the reported scarlet fever in the 6 to 12 age group (both inclusive), the writer feels that active immunization should be restricted to the first-grade children and such younger children as can be reached. The preliminary Dick test can then be omitted. However, a retest should be made 1 to 6 months after the last immunizing dose.

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Appendix A

A MODIFIED BROTH FOR TOXIN PRODUCTION

From the beginning of the experimental work with purification of the toxin it was evident that the steps involved in the purification process were somewhat intricate, though not sufficient to render the procedure impracticable. However, simplification is always to be

desired; and with that in mind, further study has been given to this point in preparing the purified and precipitated toxin.

In an earlier report (*10*) the writer mentioned that the usual broth employed for streptococcus toxin production contained an amount of nitrogenous material far in excess of maximum growth requirements. In fact, one-quarter strength broth produced as much toxin as full strength.

Another factor to be considered is the character of the protein which remains in the antigenic material, aside from the protein of the toxin itself. If this is an homologous protein it may be expected to eliminate such reactions as would occur through the injection of heterologous proteins. Therefore, human placenta has been used as the base for the culture media. The placentas, with all attached membranes and blood, are quickly cooled and this material is used, weight for weight, in place of the beef, or veal, formerly used in making tryptic digest broth.

Full-strength Douglas tryptic digest human placenta broth is made by the usual formula, and from this the diluted broth is prepared as follows:

Full strength broth of pH 7.2	250 cc.
Sodium chloride	5 gm.
Phosphate buffer of pH 7.0	100 cc.
Distilled water	650 cc.

Bring the media to a boil and filter through paper. Distribute into culture flasks of the desired volume which have been fitted with stoppers, as previously described. Sterilize in the autoclave in the usual way. When cold, add 1 percent of sterile human serum, 0.75 percent dextrose (use a 50 percent sterile solution), and 0.3 percent of a 0.25 percent alcoholic solution of phenol red. These additions are made through the tube in the stopper, as already described. Incubate for sterility and culture for toxin production in the manner previously outlined. Growth proceeds somewhat slower in this diluted, buffered broth.

Purification and precipitation of this toxin is accomplished as described above, but with the following change: The alcohol precipitation step is omitted. Two percent of glacial acetic acid is added to the cool toxin (0–5° C.). As soon as the precipitate has formed, it is discarded by filtration through a Berkefeld or Seitz filter. Precipitation with 0.5 percent tannic acid is made at this point in the manner outlined above. There is essentially no loss in potency through acid precipitation alone, whereas with the inclusion of the alcohol step a considerable loss follows.

The following report represents the analysis of one such batch of purified and precipitated toxin:

A. Total nitrogen per 100 cc of crude toxin..... 70.6 mg.
B. Total nitrogen per 100 cc acetic acid precipitated toxin..... 53.8 mg.
C. Total nitrogen per 100 cc acetic acid-tannic acid precipitated toxin... 27.6 mg.

The potency of either the crude toxin or the acetic acid-precipitated fraction was approximately 100,000 STD by direct skin reaction comparisons and the same by toxin-antitoxin neutralization tests.

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TYPHOID VACCINE: THE TECHNIQUE OF ITS PREPARATION AT THE ARMY MEDICAL SCHOOL

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The production of typhoid vaccine for use in the Army, and other Government services, was begun by Brig. Gen. Frederick F. Russell, O. R. C. (then captain, Medical Corps), in 1908, at the Army Medical School. The procedure adopted was a modification of the English and the German methods, the aim being to make a sterile, standardized suspension of typhoid bacilli with their essential immunogenic constituents as little changed as practicable.

While the technique of preparation originally adopted has been followed, with modifications, up to the present, this has not resulted from an unconsidered adherence to tradition. The organism used, when tested by means available at the time, was thought to possess two qualities which rendered it especially suitable for vaccine production, namely, low toxicity and high immunogenic potency. However fortuitous the adoption of the strain may have been, the results from its use since 1909 have amply justified its selection. The technical difficulties surrounding comparative studies have made it necessary to proceed with great caution in work which has had as its object the substitution of a superior strain.

During the few years prior to 1935, studies in various laboratories had revealed technical methods which held promise of yielding valuable information. Taking such developments into consideration,

systematic research was begun in October 1934, at the Army Medical School, upon the possibility of finding a strain of *Eberthella typhosa* whose immunizing potency might be even higher than that of the Rawlings strain and at least its equal in practical ways. Of the work planned, studies already completed have been published (*1*) and further reports will be made from time to time. As a result of 2 years' work, a strain has been found which gives evidence of being superior to the Rawlings and other strains tested, and a recommendation was made to the Surgeon General of the Army on October 10, 1936, that this new strain (No. 58) be substituted for the Rawlings strain in the routine preparation of the vaccine. The recommendation was approved October 12, 1936, since which time all antityphoid vaccine manufactured at the Army Medical School has been prepared from this strain.

THE BIOLOGICS PRODUCTION DIVISION, ARMY MEDICAL SCHOOL

General.—This Division occupies the first and basement floors of the entire northwest wing of the Army Medical School. Partitions isolate the work to as great an extent as though it were housed in a separate building. In its planning and construction, facility of cleaning and exclusion of sources of contamination were primary considerations. All culture and other technical procedures associated with the preparation of vaccine are conducted in cubicles constructed of monel metal and glass (5 in number). These are rooms built inside the large laboratory rooms and separated from the outside walls of the building. They consist of individual cubicles, one each for planting, harvesting, killing, mixing, and bottling the vaccine. Ducts bring conditioned, washed, filtered, and sterilized air to them, the sterilization being reinforced by a series of 16 ultra-violet lamps. In addition, there is a steam spray outlet at the center of the ceiling of each cubicle. Before the cubicle is used, it is flooded thoroughly with steam in order to carry down bacteria-laden particles that may be suspended in the air.

All sterilizers are provided with automatic pressure or temperature controls, or both, and recording thermometers. Incubators, in addition to temperature controls and recorders, are provided with air circulating and humidifying devices. These assure moist atmosphere and uniform temperature throughout.

THE PREPARATION SUBDIVISION

Glassware.—As glassware comes in at the receiving entrance it is sterilized by steam under pressure, by boiling, or by a combination of both methods. It is then washed, drained, and finally dried in a large oven drier designed for the purpose. The small ampules, vials, and bottles which are filled with the vaccine for distribution are washed

on a manifold water-jet device which permits the simultaneous rinsing of 150 of these small containers. After being thoroughly cleansed, the water remaining in them is blown out by compressed air. They are then placed in metal boxes and sterilized by hot air for 5 hours at 240° C. In these boxes they are taken to the filling cubicle and there receive their specified amounts of the finished vaccine.

Culture media.—Veal infusion, the basic ingredient of the culture media used in the preparation of the vaccine, is made as follows:

Lean veal (freed from fat and fibrous tissue)	10,000 gm.
Distilled water	10,000 cc.

Place in the refrigerator for 18 to 24 hours. Remove and bring slowly to the boiling point; continue boiling for 45 minutes; strain through cheesecloth and press out as much fluid as possible; bring the volume up to 10,000 cc by addition of distilled water; place in 2-liter flasks; autoclave at 15 pounds for 30 minutes; store in refrigerator. Stock infusion more than 21 days old is not used in the preparation of vaccine.

Veal infusion broth

Peptone	10 gm.
Sodium chloride	5 gm.
Agar (powder)	18 gm.
Veal infusion	1,000 cc.

Mix and heat to dissolve the agar; adjust the reaction to pH 7.4; fill into plugged and sterilized Kolle flasks (each flask receives 45 cc); autoclave at 15 pounds for 30 minutes; check pH (if it is not about pH 7.2 it is not used for vaccine production).

Upon removal from the autoclave, place the Kolle flasks on a level table to allow the agar to harden; incubate them for 24 hours to check their sterility; store at room temperature until they are to be inoculated. For convenience, the flasks are handled in metal trays each holding 50 flasks. In the parlance of the laboratory such a tray of 50 flasks is a unit designated as a "section".

A few hours before they are to be inoculated, the sections are placed in a preheating incubator (held at 45° C.) located just outside the inoculating cubicle. This is to insure their being near blood heat when they are planted, to eliminate the lag in growth which results from chilling.

Sterility broth.—This medium, recommended by the National Institute of Health, United States Public Health Service, for use in routine sterility tests, is prepared as follows:

"To 8 kilograms of ground fresh meat freed from fat, 16 liters of distilled water are added and the mixture is infused in the ice chest 24 hours. Sixteen liters of juice are squeezed out through cheesecloth, heated in streaming steam for 1 hour, autoclaved at 15 pounds pressure for 30 minutes, filtered through moistened paper, and brought up to

the original volume. Five grams of sodium chloride per liter and 10 grams of peptone per liter are added and the broth is stirred until solution takes place. The pH is adjusted to such a point as experience shows will result in a pH of 7.5 in the final broth in the fermentation tubes by adding solution of sodium hydroxide. The broth is heated in streaming steam for 30 minutes, filtered through moistened paper, placed in glass-capped Smith fermentation tubes, each containing at least 25 cc and holding a seal of at least 1 centimeter in the open arm, and autoclaved at 15 pounds pressure for 20 minutes. The Smith fermentation tubes should be in racks which facilitate tipping oxygen bubbles out of the long arm when hot, or which allow such bubbles to flow out of the tubes while the heating is going on, and which permit ready inspection of all parts of the tube for growth. The design in use at the National Institute of Health is recommended. If the broth is not to be used immediately, it may be filtered into flasks containing not more than 1,500 cc each, sterilized by streaming steam for 2 hours or by autoclaving for 20 minutes at 15 pounds pressure, and stored prior to filling into fermentation tubes.

"To detect contamination, the fermentation tubes may be incubated for a few days, or an adequate number (about 20 percent) of controls planted with material known to be sterile, simultaneously with the tests. Not more than 5 hours before planting, the fermentation tubes shall be heated to fully 100° C. for 30 minutes and immediately tipped to expel the air from the long arm unless the tubes are arranged in the sterilizer so that the bubbles leave each tube while being heated. The pH at this point should be between 7.2 and 7.8; but instead of repeated adjustments of reaction during the process of preparation of the medium, it is preferable to add enough alkali in the beginning to insure a proper reaction when all the steps are completed. The amount to be added can be ascertained only by repeated trials, using the same ingredients. No acid should be added at any point in the process.

"No dextrose need be added to the batch of medium provided a preliminary test has shown that it contains an appreciable amount of muscle sugar. This test is made by inoculating two Smith fermentation tubes, filled with the fully prepared and sterilized medium, with an active strain of colon bacillus. If, after overnight incubation, both fermentation tubes show a bubble of gas filling the tip of the closed arm, sufficient sugar may be assumed to be present. If not, or in the absence of such a test, approximately 0.03 percent of dextrose should be added just before the final heating in the fermentation tubes. For this purpose 1 percent dextrose solution in flasks containing not more than 50 cc each should be sterilized in the autoclave at 15 pounds pressure for 15 minutes, and added to the broth in the proportion of 1 cc to each fermentation tube. Planting is done within 5 hours after the broth has cooled."

Buffered saline solution.—This is the menstruum in which the agar growth of typhoid bacilli is suspended, 30 liters being provided for each "section" of 50 Kolle flasks. For convenience this is distributed into four 8-liter bottles, each containing 5 liters of the saline, and the remainder in 1-liter and 2-liter Erlenmeyer flasks.

The formula for the buffer solution is as follows:

NaH_2PO_4	28.81 gm.
Na_2HPO_4	125.00 gm.
Distilled water, q. s. ad	1,000.00 cc.

The buffer solution is added to the saline (which is 0.85 percent NaCl in distilled water) in the proportion of 20 cc of buffer to each liter of saline solution. The buffered saline solution is then sterilized at 15 pounds for 1 hour.

Mucin.—For the preparation of the mixture of crude hog stomach mucin in which the test doses of living typhoid bacilli are suspended, for injection intraperitoneally into mice, three sterile solutions are used at the present time:

1. To 75 gm of mucin, powdered by grinding in a ball mill, add 800 cc of distilled water, mix thoroughly and allow to stand in the refrigerator overnight (granular mucin requires 18 hours in the refrigerator). Remove and stir with a motor-driven mixer for 2 hours; make up the volume to 1,320 cc with distilled water; autoclave at 10 pounds for 15 minutes.

2.

K_2HPO_4	20.25 gm.
KH_2PO_4	4.32 gm.
Distilled water q. s. ad	165.00 cc.

Mix and autoclave at 15 pounds for 30 minutes.

3.

Dextrose C. P	7.5 gm.
Distilled water q. s. ad	15.0 cc.

Sterilize by filtration or by heating at 80° C. for 1 hour on each of 3 successive days.

Mix these three solutions under sterile conditions, using flame technique. Check the reaction—it will be pH 7.2; test for sterility. Store the mixture in a refrigerator. Before a portion is withdrawn for use, agitate the mixture thoroughly until all sediment is uniformly in suspension.

In order to secure information concerning some of the essential qualities of a useful mucin mixture, estimations are made, on every lot, of viscosity and total and nonprotein nitrogen content. Furthermore, active studies are in progress which have as their aim a simplified process and a uniform product as well as the elucidation of the problem of the mode of action of the mucin.

Cotton swabs.—These are ordinary cotton swabs, of rather large size used for inoculating the agar in the Kolle flasks. They are made by applying absorbent cotton to the ends of iron wire rods, and are inserted into large test tubes and sterilized in the autoclave for 1 hour at 15 pounds pressure.

Collecting flasks.—These are heavy-walled Erlenmeyer flasks with a graduation mark indicating 2,000 cc. They are fitted with two-holed rubber stoppers. One of the openings in the stopper carries a glass tube 3½ inches long which, in operation, is attached by sterile rubber tubing to the vacuum system; the other opening is for a shorter glass

tube to be connected with the harvesting tool. This latter tube is flanged at its lower end and has attached to it a filter bag consisting of three layers of gauze. The collecting flasks, with their stoppers in place and covered with muslin, are autoclaved at 15 pounds for 30 minutes.

The harvester.—The harvester is a metal tube 13¼ inches long with a short section 1½ inches long fixed to its distal end to form a T. The transverse piece will pass into the Kolle flasks through the broad oval neck; it is closed at both ends and has a narrow opening or slot running nearly its entire length on one flattened side. The harvester serves as a rake to loosen the growth of bacteria from the surface of the agar, then the suspension thus formed is aspirated, through the slot, into the collecting flask. The harvesters, after being wrapped in muslin, are sterilized in the autoclave at 15 pounds for 30 minutes.

Cotton stoppers.—These are gauze-covered cotton plugs provided to replace the rubber stoppers in the 2-liter collecting flasks. They are wrapped in muslin and sterilized in the autoclave at 15 pounds for 30 minutes.

Graduated cylinders.—Graduated cylinders of 1,000 cc capacity are stoppered with gauze-covered cotton plugs, and, with muslin tied over their stoppers, they are sterilized in the autoclave at 15 pounds for 30 minutes.

Pipettes.—Pipettes of 10 and 25 cc capacity are sterilized by hot air at 170° C. for 2 hours.

The bottling apparatus.—This is assembled, wrapped, and sterilized in the autoclave at 15 pounds for 30 minutes.

The bottling cabinets.—The bottling cabinets are wrapped and sterilized in the autoclave at 15 pounds for 60 minutes.

Vaccine ampules and vials.—Vaccine ampules (1 cc) and vials (5, 10, 25, and 50 cc) are washed and dried, packed in trays, in metal boxes, and sterilized by hot air at 240° C. for 5 hours.

Rubber stoppers.—Rubber stoppers to fit the vaccine vials are of special composition. They are washed thoroughly in several changes of hot water, then autoclaved for 30 minutes at 15 pounds pressure. Then they are washed again, placed in 0.8 percent phenol solution, and again autoclaved while still immersed in the phenol solution at 15 pounds for 30 minutes. For use they are removed from the phenol solution in small quantities as needed to stopper the filled vaccine bottles.

Rubber gloves.—Rubber gloves are washed in 2 percent phenol and sterilized at 15 pounds pressure for 30 minutes.

Gowns and other clothing.—Gowns and other clothing worn exclusively by the technicians while working in the cubicles are sterilized in the autoclave at 15 pounds for 30 minutes. The sterile clothing is put on after the technicians have entered the cubicles.

Shoes.—Shoes are wet just before use by dipping their soles in a shallow pan containing a gauze pad wet with cresol solution.

Large earthenware jars.—Large earthenware jars containing 3 percent cresol solution are provided for the disposal of tubes and other materials contaminated by living bacteria.

The seed culture.—Since October 12, 1936, *Eberthella typhosa* 58 has been used in the preparation of the Army typhoid vaccine. This strain was isolated from the feces of a chronic carrier, in Panama, who had typhoid fever in 1913 and who, since that time, has been under the continuous observation of Dr. L. B. Bates, Director of the Board of Health Laboratory, Panama Canal. The culture was received in September 1934, immediately after isolation from the carrier.

The surface colonies of this strain, on plain agar plates, are relatively large, with a moderate dome which is somewhat flattened; edges are slightly undulate; surface is smooth; consistency is moist and homogeneous; the growth mixes evenly with saline; it does not agglutinate in 6.4 percent saline; it grows with uniform turbidity in broth without granular clumps; surface pellicle is absent in young cultures, and there is no sedimentation. The bacilli are actively motile, and are uniformly small, short rods. Studies of the bacterial count of finished vaccines seem to indicate that Strain 58 has more tendency to autolyze than does the Rawlings strain. When suspended in mucin their virulence is such, when inoculated intraperitoneally, that 10, 100, or 1,000 living bacilli will kill all white Swiss mice or black mice (Strain C–57) of 16 to 18 gm weight within 72 hours.

It is well known that many bacteria lose certain parasitic attributes after continuous cultivation on artificial culture media. In order to avoid such changes and to maintain the vaccine cultures without alteration or dissociation, large numbers of ampules containing the frozen and dried cultures are kept in stock. For this method of preservation the apparatus of Flosdorf and Mudd is used. This apparatus consists of a glass or metal manifold having 24 outlets with a main and secondary condenser connected in series, immersed in a bath of dry ice (solid CO_2) and an antifreeze solution, contained in an insulated vessel. The secondary condenser is connected with the vacuum pump.

Broth suspensions of the agar cultures, grown for 12 hours at 37.5° C., are distributed in small amounts, usually 0.2 cc, into ampules. The ampules are immersed in a dry-ice bath (temperature about −78° C.) for 10 to 15 minutes. At the end of this time the ampules are rapidly connected to the manifold and the vacuum pump is started. Moisture is removed from the frozen material by sublimation *in vacuo* and is trapped in the condensers. A vacuum of 0.70 mm Hg, or less, will keep the cultures frozen until drying is complete. This requires

about 6 hours. Then, with the vacuum pump still operating, the ampules are sealed off individually, using a gas-oxygen hand torch. The dried cultures are stored at 2° to 5° C.

When a lot of vaccine is to be manufactured, an ampule is broken, about 0.2 cc sterile distilled water is added, and a culture in veal infusion broth is made from the resultant suspension. After incubation for 2 hours, streak cultures are made on veal infusion agar in Petri dishes; a series of 10 plates is made; these cultures are grown in the incubator overnight. The following morning the colonies developed are studied with great care, using a binocular dissecting microscope. Typical smooth colonies are fished to agar slants in large (50 by 200 mm) test tubes; a part of the same colony is planted to a tube of Russell's double sugar agar, by streak and stab. These cultures are all incubated overnight. The growth on each of the large agar slants is the seed for the inoculation of one section of 50 Kolle flasks. The growth in these large culture tubes is suspended in 25 cc of veal infusion broth and the suspension transferred to clean sterile tubes of the same size. After incubation for 2 hours these tubes are ready to be taken to the cubicles and used for the inoculation of the agar in the Kolle flasks.

The few drops of suspension left in the culture tubes are studied to determine the purity and identity of the growth. Motility is checked in hanging drop, and staining reaction and morphology are ascertained on a gram-stained slide. A suspension showing any tendency to auto-agglutination is discarded; those in which there are long thread-like forms are not used, partly for the reason that the threads interfere with accuracy in counting.

The Russell double sugar cultures, which were made as duplicates from colonies used to inoculate the seed cultures, must show typical acid butt and alkaline slant, with no gas formation. The growth from these Russell slants is suspended in buffered saline and used to make agglutination tests. The result must be positive to the limit of potency of the agglutinating serum used. The tubes containing the appropriate mixtures of agglutinating serum and suspension are held at 56° C. for 2 hours and then placed in the refrigerator overnight.

THE PRODUCTION SUBDIVISION

Planting the Kolle flasks (fig. 1).—Before they are placed in the special incubator, where they are brought up to 45° C. preparatory to inoculation, the Kolle flasks are examined for cracks and other flaws, for imperfect cotton stoppers, and for any indication of contamination of the agar. Only flasks perfect for the purpose are transferred from the preparation subdivision to the production subdivision.

Two technicians work together in the planting cubicle. They wear only sterilized clothing and only they enter the cubicle. The cubicle

FIGURE 1.—Inoculating the Kolle flasks.

FIGURE 2.—Collecting the growth from the Kolle flasks.

FIGURE 3.—The pooling and mixing chamber. Steam hose connected for sterilization.

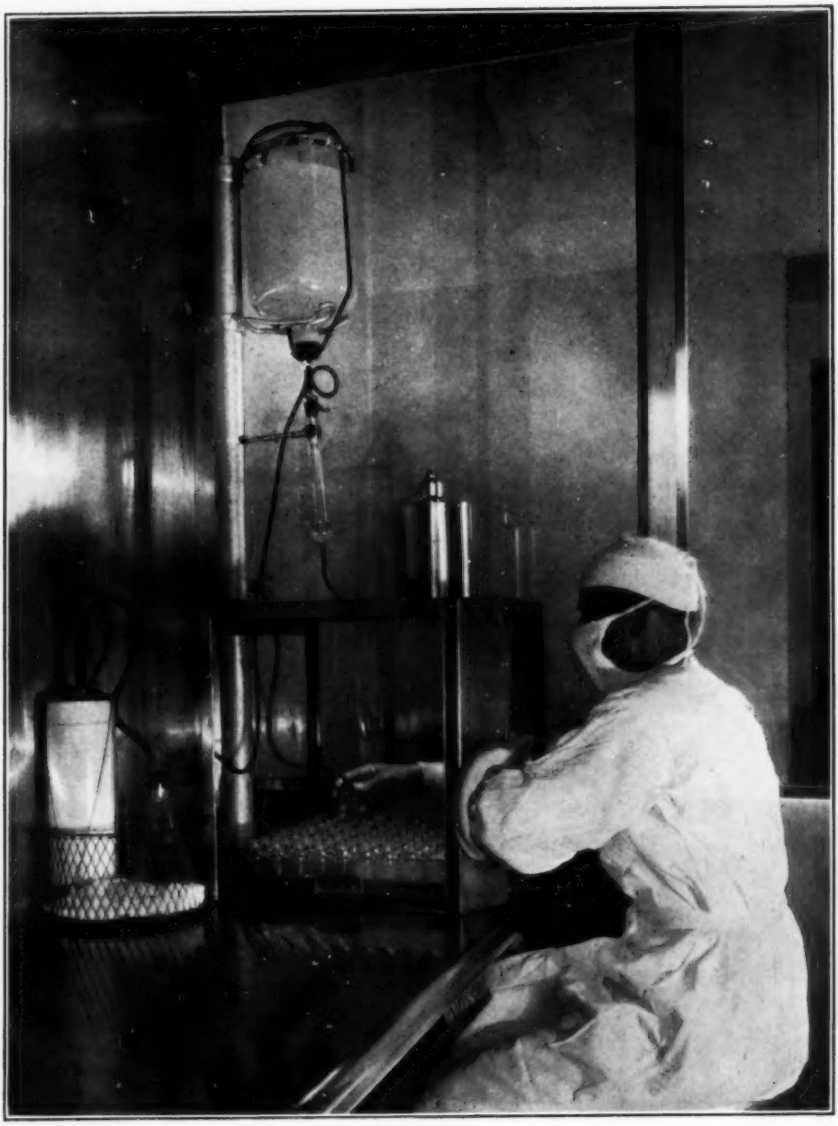

FIGURE 4.—The bottling apparatus, showing bottling cabinet.

has been steamed and now is receiving sufficient sterilized air to create distinct positive pressure so that no drafts can enter through any accidental leak that may have escaped careful inspection.

The technique of inoculation is simple. The equipment used consists of the section of flasks, the tube of seed culture held in its support, the cotton swab, and the Bunsen burner. A flask is picked up, the cotton plug removed, the mouth of the flask flamed, the cotton swab inserted into the seed culture suspension, then removed and passed over all parts of the surface of the agar in the flask, the swab is replaced in the seed tube, the mouth of the Kolle flask is flamed again, the cotton stopper is put back into the flask, the flask is returned to its rack, which is inclined so that water of condensation will run off the surface and collect at the low edge of the agar. Then, flask after flask is inoculated in the same manner. When all the flasks of a section have been thus planted, the tray with its 50 flasks is placed in the specially constructed incubator, with temperature and humidity control and circulating air, where it remains overnight, usually from 18 to 22 hours at 37.5° C.

As an important check on the maintenance of purity of the seed culture suspension, throughout the process of planting the flasks the portion of the suspension remaining in the tube, at the end, is plated on plain veal infusion agar. This must be a pure culture of the typhoid organism.

Harvesting (fig. 2).—Before the collection of the growth is begun, each Kolle flask, planted the day before, is inspected with the greatest care. Any flask showing the slightest suspicious evidence of atypical growth or contamination is discarded.

The materials required are the harvesting tool, flasks of sterile buffered saline, the 2-liter collecting flask with its rubber stopper and tubes, and the Bunsen burner. As noted in a preceding paragraph, one of the glass tubes has a gauze filter bag secured about its opening inside the collecting flask, the outer end of this tube being connected by means of sterile rubber tubing with the harvesting tool; the other glass tube is connected with the vacuum system. The rubber tubing for making these connections is sterilized separately in the autoclave, and the connections are made immediately before the harvesting begins; flame technique is used in this procedure.

Two technicians work together. A Kolle flask containing the growth of organisms is picked up by one man, who removes the cotton plug, flames the mouth, and pours into it about 20 cc of buffered saline. It is passed to the other man who, first using the collecting tool as a rake, carefully scrapes the bacterial growth from the surface of the agar. The growth readily mixes with the saline and makes a heavy, milky suspension; this suspension is then aspirated into the flask by releasing, to exactly the proper degree, the

pressure he maintains on the rubber tubing. The aspiration of air increases the danger of contamination. By the time the growth has been removed from the first flask, a second is ready with its 20 cc of saline added. This procedure is continued until the suspended bacteria of the entire section are in the collecting flask. The rubber tubes are removed from their glass connections in the rubber stopper, and the rubber stopper is taken out and replaced by a sterile gauze covered cotton stopper; then sufficient sterile buffered saline is added to bring the amount in the collecting flask up to 2 liters.

After thorough agitation to insure uniformity of the suspension, samples are removed—one of 10 cc for counting, and one of exactly 2 cc for the virulence test. The 2-cc quantities from each of the collecting flasks, resulting from 1 day's work, are pooled and kept cold until diluted for the mouse injections—about one-half hour. After it is labeled, the collecting flask is carried to the killing cubicle.

Killing.—The water bath provided for this purpose is heated by electricity, the temperature being automatically controlled to 0.1° C. The water is kept in constant circulation by a motor-driven pump to assure uniform temperature in all parts of the tank. It is of such size that 12 flasks of 2-liter capacity may be heated simultaneously. One flask containing water, and with a thermometer in it, serves as a guide to the rapidity with which the temperature in the other flasks rises and indicates when it reaches the desired maximum point (56° C.). The flasks rest on a perforated shelf raised from the bottom; the water is of such depth that its level is well above that of the suspension in the flasks. The flasks containing the concentrated suspensions are held in the water bath for 1 hour after the temperature in the control flask has reached 56° C. Upon removal from the bath, the flasks are allowed to cool to room temperature.

Standardization.—While the suspension is in the water bath, the 10-cc sample, collected at the completion of its harvesting, is counted. The technique employed is the direct method, using a Helber blood counting cell. The following are the steps in this procedure:

The heavy suspension received from the collecting flask is diluted with sterile buffered saline, in the proportion of 1 cc of suspension to 29 cc saline (in practice, 1+9; then, of this, 1+2); then this diluted suspension is mixed for counting as follows:

	cc
Diluted suspension	1.0
Sterile buffered saline containing 1.0 percent formalin	3.5
Carbol-methyl violet solution [1]	0.5

	cc
[1] Saturated alcoholic solution methyl violet 6B	1.0
5 percent aqueous solution of phenol, q. s. ad	100.0

The final dilution as counted is thus 1 to 150.

Place the mixture in a test tube; warm it over a Bunsen flame until it is almost at the boiling point; let it stand for 1 minute, then cool rapidly by placing it in ice water. With a capillary pipette, transfer a drop of the well-shaken mixture to a Helber cell-counting chamber, using a Hausser cover glass, 0.18 mm thick. On the microscope stage, find the ruled squares with the ⅔-inch objective; place a drop of cedar oil on the cover glass; turn to the oil immersion lens and bring the ruled area into focus; wait 10 minutes to allow the bacilli to settle into the same focal plane; count the number of bacteria in 20, or more, small squares, using the fine adjustment to detect bacilli which may not have settled; calculate the average number of bacteria per square. The squares are $\frac{1}{20}$ mm by $\frac{1}{20}$ mm; the chamber is $\frac{1}{10}$ mm deep; therefore, if the average number of bacilli per square was found, let us say, to be five, we would have in each cubic millimeter of the suspension which was mixed with the stain: $20\times20\times50\times5=100{,}000$. The number per cubic centimeter would be 1,000 times this, or 100,000,000. This figure, finally, is multiplied by the number of times (150) the original suspension was diluted for counting.

(NOTE.—The complete mathematical problem involved herein is avoided by a practical "short-cut" formula, as follows: Count the total number of bacilli found in 20 squares; multiply this figure by 0.3; the result will be the number of liters of vaccine of 1,000 million per cubic centimeter strength to be made from the 2 liters of heavy suspension in a collecting flask.)

Virulence test.—Black mice of a pure strain, known as Strain C–57,[1] have been found suitable for this test because of their relatively uniform susceptibility to typhoid infection by the intraperitoneal route. At the time of injection they weigh between 16 and 18 grams.

As previously noted (p. 838), from each of the 2-liter flasks of suspension harvested on one day, 2 cc are removed and mixed. This representative pooled suspension of live organisms is counted, in the regular way, then it is diluted so that the doses injected into the mice will be contained in 0.5 cc. Ringer's solution is used first to bring the number of bacilli in 1 cc down to 10 times the strength of the suspension injected into the mice; the final (1:10) dilution is made in mucin. Thus, the standard doses used to test the virulence of Strain 58 are 10,000, 1,000, and 100 bacilli; these numbers are to be contained in 0.5 cc. Therefore, with Ringer's solution the original suspension is diluted first to 200,000 bacilli per cubic centimeter; of this concentration, 1 cc is mixed with 9 cc Ringer's solution, giving 20,000 bacilli per cubic centimeter; then 1 cc of this second suspension is diluted with 9 cc Ringer's solution, making a suspension of which 1 cc contains 2,000 bacilli. Each of these three suspensions is then

[1] This is a pure genetic strain of black mice developed by Dr. C. C. Little, director of the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine. We have used this strain in all our recent experimental work on typhoid vaccine and found it to be highly satisfactory.

mixed in the proportion of 1 cc plus 9 cc of sterile buffered mucin mixture; the resultant mucin suspensions will contain in 0.5 cc amounts, the proper doses for the mice—10,000, 1,000, and 100 bacilli.

For the purposes of this test, 10 mice are injected with each dose. The mice are held under observation for 72 hours, when the result is recorded. It is expected that all mice receiving the higher doses will die within this period; some of those receiving the lowest dose may survive.

As a check on the cause of death, at least two mice are examined and cultures are made from the heart blood on veal infusion and EMB agar plates. Colonies are fished to Russell's double sugar and subjected to microscopic examination and agglutination tests.

These tests for mouse virulence are believed to be important. The indications which may be drawn from work done at the Army Medical School are that virulence and immunogenic potency tend to parallel one another.

Dilution.—Harvesting is completed in the earlier hours of the morning. Then the collected bacilli are killed in the water bath while the numbers of organisms per cubic centimeter in each flask of suspension are being determined by direct count. These procedures accomplished, the work for the afternoon is that of diluting the heavy suspension with buffered saline so that each cubic centimeter will contain 1,000 million bacilli. As a preservative, and to kill any bacilli surviving the temperature of the water bath, tricresol is added to a concentration of 0.25 percent.

The materials placed in the cubicle for making the dilutions include the following: The 2-liter flasks of concentrated, heated, suspension of bacilli labeled to show the result of the count, vaccine stock bottles of 8-liter capacity, each containing 5 liters of sterile buffered saline, several 1-liter and 2-liter flasks of sterile buffered saline, sterile 1,000-cc cylinder graduates, sterile 10-cc graduated pipettes, and a bottle of tricresol. For each of the 2-liter flasks of concentrated suspension, a suitable number of the 8-liter stock bottles is provided. Each of these has been tagged to show the calculated amount of the various components these stock bottles are to receive. The information on the tag is recorded as follows:

TYPHOID VACCINE

No ---------- Section ----------
Date made ----------
Amount of tricresol ---------- cc
Amount of suspension ---------- cc
Amount of salt solution ---------- cc
Total amount of vaccine ---------- cc
Standardization: 1,000 million per cubic centimeter.

In making the dilution, the officer who does this work notes first the amount of tricresol required and measures the proper quantity into the 5 liters of sterile saline contained in the 8-liter stock bottle. The bottle is then shaken until thorough solution of the tricresol has been effected. Next the quantity of saline needed beyond the 5 liters is added from the 1-liter and 2-liter flasks provided. Finally, the amount of concentrated suspension shown on the tag is measured into the stock bottle, using for this the sterile graduated cylinder. After thorough agitation the bottle of diluted vaccine is set aside at room temperature for 48 hours. At the end of this time sterility tests are made. These consist of planting two fermentation tubes containing National Institute of Health sterility broth. If, after 96 hours' incubation no bacterial growth can be detected in any of the fermentation tubes, the vaccine is ready to be pooled.

Pooling.—In order that minor differences which may occur in the specific potency of various small lots of vaccine may be minimized, the contents of twenty to twenty-five 8-liter stock bottles are mixed or pooled. For this part of the work one cubicle is used exclusively. In it are the mixing chamber (fig. 3) and a steam generator. The mixing chamber is a heavy monel metal barrel, so set that it can be rotated on its axis, while inside it are baffles which aid in the thorough mixing of its contents. In its resting position it has, at its upper and lower sides, threaded tubulatures. The upper is closed by a cap which may be removed to be replaced by the steam-hose connection for sterilization or by a hooded sterile funnel to receive the vaccine which is to be pooled; the lower opening is protected by a bell-shaped funnel under which sterile bottles are placed to receive the pooled vaccine through a large stopcock. For sterilizing the chamber an arrangement of checkvalves, like those on autoclaves, is attached to the lower opening; this insures the escape of all air and condensation water, thus making the process of sterilization of the chamber identical with that of an autoclave. The special generator produces steam rapidly and in ample amount; a heavy, high-pressure hose conveys the steam to the upper opening. The chamber is sterilized for 20 minutes at 15 pounds pressure, just long enough beforehand to give it time to cool before the process of pooling is begun.

With the hooded funnel in place and the cut-off valve below, closed, vaccine is carefully poured in at the top, using flame technique. This completed, the barrel is turned back and forth by means of a large crank to mix thoroughly and insure uniformity of strength of the contained vaccine; then an air filter is attached to the upper opening, and the vaccine is drawn off into sterile 8-liter stock bottles, placed in succession under the funnel below.

These filled stock bottles are stoppered and labeled and their contents tested for sterility. The sterility tests are identical with those made on the vaccine 48 hours subsequent to dilution.

Biological tests.—Six animals are used in testing each lot of vaccine. Four mice each receive 0.5 cc of the vaccine intraperitoneally; a guinea pig receives 0.5 cc intraperitoneally for each 100 gm of its weight; a rabbit receives three doses—the first 0.5 cc subcutaneously, the second, 7 days later, 1 cc intravenously, and after 7 more days 1 cc intravenously. Ten days subsequent to the third dose the rabbit is bled and the specific agglutinin titer of its serum is determined. It is generally between 1:5,000 and 1:10,000. The agglutinating suspension consists of living bacilli (500 million per cubic centimeter) suspended in physiological saline. The tubes are incubated at 56° C. for 2 hours and stored in the refrigerator overnight. Complete agglutination only is read. These tests for agglutinins in the blood of the rabbit are intended only as a check on the identity of the bacilli in the vaccine. The mice and the guinea pig serve as checks on the tricresol content and the presence of any directly toxic or infectious substance. These animals are observed for 10 days. All animals dying within this period are carefully examined to determine the cause of the fatality. It must be ascertained whether or not death resulted from an intercurrent infection or from some cause inherent in the vaccine. If death from intercurrent infection should happen to be excluded, the tests are carefully repeated.

The reaction of each lot of vaccine is determined colorimetrically. Phenol red, 0.5 cc of a 0.02 percent solution, is added to 10 cc of vaccine. The buffer in the suspending saline solution holds the reaction at about pH 7.2. As a check on the quality of the glass, that is, to ascertain whether or not soluble substances in the glass are affecting the reaction of the vaccine, the pH of retained samples is investigated several months after filling.

Bottling.—The vaccine is distributed in 1-cc ampules and in 5-, 10-, 25-, and 50-cc vials. These are received at the filling cubicle in the metal boxes in which they were sterilized. The process of filling is illustrated in figure 4. It will be noted that the filling box is open on the side nearest the camera. In actual use the sides are closed by sterile towels wet with 3-percent cresol solution. In order to illustrate the filling technique, the towel was removed for this picture.

The stock bottle of vaccine is inverted above the sterilized filling cabinet after having been fitted with a rubber stopper which has two glass tubes running through it. One of these, the air-inlet tube, reaches nearly to the bottom of the bottle and is connected outside with a phenol solution air-washing bottle and a sterile cotton air filter. The other, the filling tube, is short, ending just inside the stopper. As the vaccine runs out through this tube, it passes by means of suitable rubber tubing through a sterile gauze filter, then through another rubber tube which enters the filling cabinet. The end of this tube has inserted into it a small section of glass tubing tapering to

form the filling nozzle. A pinch-cock clamps the rubber just above this end piece.

When the stock bottle of vaccine is in place, a tray of sterile ampules or vials is passed into the sterilized filling cabinet, then the technician, wearing sterilized clothing and rubber gloves, passes his hand into the cabinet through stockinette sleeves and fills the small containers one after another by manipulating the pinch-cock. The tray of filled containers is removed and stoppered, another tray immediately taking its place.

Final sterility tests.—The vaccine, bottled for issue, is stored at room temperature for 48 hours. Then sterility tests are made upon a random sample taken from a number of bottles. The number of bottles in the sample depends somewhat upon the number filled from the lot of vaccine. The following schedule is used:

Number of bottles filled:	*Number of bottles tested*
100 or less	3
101 to 150	4
151 to 200	5
201 to 250	6
251 to 300	7
301 to 350	8
351 to 400	9
Over 400	10

From each ampule or bottle at least two fermentation tubes are planted; one receives 0.25 cc, the other 1 cc of the vaccine. Care is exercised in the inoculation procedure to introduce the vaccine into the closed arm as well as into the aerobic chamber of the fermentation tubes.

Prior to inoculation all fermentation tubes are placed in an Arnold sterilizer for 30 minutes at 100° C., cooled to room temperature and planted immediately. Each tube is carefully inspected for air bubbles in the closed arm. If present, the tube is not used. The fermentation tubes are incubated at 37.5° C. for a period of 7 days. They are inspected at the end of 48, 96, and 168 hours. The vaccine may be released for distribution or shipment only if every tube is free of all evidence of bacterial growth.

Retained samples.—When a lot of vaccine is bottled for distribution, a number of the ampules and vials from that particular lot are withdrawn and stored for an indefinite period of time. When the contents of one 8-liter stock bottle is transferred into ampules and vials, the number of samples retained consists of five 1-cc ampules, two 5-cc vials, one 10-cc vial, one 25-cc vial, and one 50-cc vial. These samples are then available for future studies, such, for example, as a study to determine evidence of any deterioration which might occur.

Immunogenic potency test.—There is at present no generally accepted method by which the relative specific activity of typhoid vaccines

may be titrated. The need for such a test is self-evident, and work is now in progress at the Army Medical School which has as its object the development of a method for comparative standardization. The results of these studies will be the subject of a supplementary report.

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(1) Protective Antibodies in the Blood Serum of Individuals after Immunization with Typhoid Vaccine. By the Laboratory Staff, Army Medical School, Washington, D. C., under the supervision of J. F. Siler, M. D., Am. J. Pub. Health, 27 (2): 142 (February 1937).

PROVISIONAL SUMMARY OF INFANT MORTALITY, BY STATES, FOR 1936 AND COMPARISON WITH PRIOR YEARS

Provisional tabulations recently issued by the Bureau of the Census [1] show that there were 121,525 deaths of infants under 1 year of age in the United States in 1936, as compared with 120,138 reported in 1935. These figures give a provisional infant mortality rate (number of deaths under 1 year of age per 1,000 live births) of 56.9 for 1936, as compared with 55.7 for 1935. While this indicates a slight increase in infant mortality for 1936, the rate is still definitely below the general level of the past decade.

In terms of the infant mortality rate, 19 States showed some decrease and 29 States and the District of Columbia showed an increase. The greatest decreases in the rate were shown for New Mexico, North Dakota, New Hampshire, South Dakota, and Montana. The largest increases were for the District of Columbia, West Virginia, and Vermont.

All data for the years prior to 1936 are final tabulations. Figures for 1936 are based on hand counts of copies of death certificates received from State offices of vital statistics. For the States for which the shipment of copies to the Bureau of the Census is complete, these provisional figures will agree closely with the final tabulations. In other States it may be expected that a few delayed certificates will be added before final tabulations are completed.

For Colorado, Illinois, Rhode Island, and New York State (excepting New York City, which has made complete returns), transcripts for only 11 months have been received. For Arizona, transcripts for only 10 months have been received. In such cases, the 1936 provisional figure is based on the available 1936 data and the 1935 data for the months for which the 1936 information is lacking. The State total for Massachusetts is taken from State tabulations.

[1] Vital Statistics—Special Reports, Vol. 3, No. 23, pp. 115-117, June 14, 1937.

Number of deaths (exclusive of stillbirths) under 1 year of age in each State, 1932–36

State	1936[1]	1935	1934	1933	1932
Registration States	121,525	120,138	130,185	120,887	119,431
Alabama	3,913	3,910	4,303	3,865	3,835
Arizona	1,093	1,021	879	905	817
Arkansas	1,742	1,681	2,029	1,946	1,697
California	4,479	3,978	4,050	4,027	4,116
Colorado	1,302	1,370	1,298	1,183	1,259
Connecticut	935	951	1,085	1,087	1,173
Delaware	254	268	245	237	288
District of Columbia	847	642	662	669	740
Florida	1,668	1,736	1,821	1,614	1,674
Georgia	4,309	4,320	5,099	4,070	4,101
Idaho	512	483	471	404	379
Illinois	5,232	5,138	5,825	5,284	5,884
Indiana	2,798	2,690	2,960	2,675	2,903
Iowa	2,051	1,937	2,149	1,911	1,938
Kansas	1,556	1,539	1,574	1,646	1,525
Kentucky	3,529	3,388	3,887	3,213	3,767
Louisiana	3,118	2,933	2,971	2,785	2,804
Maine	983	990	1,112	1,002	1,017
Maryland	1,839	1,689	1,924	1,805	1,989
Massachusetts	2,854	3,041	3,125	3,299	3,624
Michigan	4,481	4,172	4,364	4,090	4,628
Minnesota	2,112	2,053	2,168	2,120	2,189
Mississippi	2,880	2,605	3,102	2,818	2,480
Missouri	3,235	3,262	3,735	3,176	3,430
Montana	592	602	532	461	467
Nebraska	1,050	960	1,141	1,193	1,091
Nevada	100	101	85	99	88
New Hampshire	356	419	478	413	460
New Jersey	2,383	2,520	2,678	2,597	3,075
New Mexico	1,402	1,705	1,613	1,674	1,479
New York	8,537	8,852	9,634	10,026	10,469
North Carolina	5,216	5,423	6,212	4,977	5,183
North Dakota	664	811	833	791	779
Ohio	5,313	5,093	5,379	5,049	5,951
Oklahoma	2,507	2,384	2,864	2,466	2,052
Oregon	615	543	521	493	531
Pennsylvania	8,120	8,194	8,812	8,391	10,113
Rhode Island	480	482	558	575	639
South Carolina	3,169	3,219	3,674	3,154	3,204
South Dakota	594	674	764	705	668
Tennessee	3,462	3,414	3,863	3,473	3,550
Texas	7,660	8,230	8,381	8,155	(2)
Utah	653	626	622	567	529
Vermont	375	320	347	325	381
Virginia	3,781	3,583	3,805	3,513	3,670
Washington	1,066	1,012	973	811	967
West Virginia	2,910	2,533	2,794	2,472	2,911
Wisconsin	2,514	2,419	2,542	2,446	2,675
Wyoming	275	223	242	230	242

[1] 1936 figures are provisional.
[2] Not in registration area.

Infant death rates (deaths under 1 year of age per 1,000 live births) for each State, 1927–36

State	1936 [1]	1935	1934	1933	1932	1931	1930	1929	1928	1927
Registration States	56.9	55.7	60.1	58.1	57.6	61.6	64.6	67.6	68.7	64.6
Alabama	67.4	62.8	67.8	65.1	60.9	61.4	72.1	73.6	75.0	64.4
Arizona	108.9	111.7	103.5	111.4	95.9	109.6	116.6	133.3	141.5	130.1
Arkansas	54.0	47.1	54.1	54.4	45.3	49.0	51.5	58.1	66.9	60.9
California	53.1	49.6	51.7	53.7	52.7	56.7	58.7	63.2	62.2	62.3
Colorado	73.0	72.7	72.7	68.9	71.5	81.0	94.3	91.4	89.4	[2]
Connecticut	42.1	42.7	48.8	48.4	49.4	53.8	56.0	64.4	58.6	58.8
Delaware	64.8	66.4	61.4	60.4	67.1	81.7	78.5	81.2	78.4	70.6
District of Columbia	72.5	59.4	65.3	67.2	72.9	67.0	70.8	70.7	65.1	67.6
Florida	59.4	61.9	68.2	62.9	61.1	63.9	64.2	65.5	67.1	67.4
Georgia	69.9	68.3	78.9	66.7	64.4	68.3	77.4	76.3	81.6	[2]
Idaho	50.5	51.0	50.3	47.2	43.4	55.9	57.1	55.3	59.0	50.0
Illinois	47.7	45.9	52.8	49.0	52.8	58.6	55.8	61.4	64.2	64.4
Indiana	51.8	50.8	56.5	53.0	54.7	57.6	57.7	63.6	62.5	58.8
Iowa	48.1	47.1	50.6	48.3	47.9	49.0	53.9	52.6	53.0	55.5
Kansas	51.9	50.3	48.5	53.5	48.1	47.9	52.6	57.6	59.0	55.3
Kentucky	63.3	58.7	64.9	58.1	63.3	65.0	65.4	70.9	69.6	61.0
Louisiana	72.8	69.4	69.1	70.1	64.8	65.9	78.2	74.0	78.4	77.4
Maine	64.6	63.0	70.6	66.3	63.1	71.5	75.7	77.4	72.5	80.0
Maryland	69.2	62.0	70.4	65.8	69.0	80.5	75.3	79.9	79.6	81.5
Massachusetts	45.3	48.3	49.0	52.0	52.9	54.5	60.1	61.8	64.3	64.5
Michigan	50.7	47.7	52.0	50.5	54.0	57.0	62.7	66.4	69.4	67.7
Minnesota	44.4	44.7	47.2	47.6	47.2	50.6	52.5	51.2	53.6	51.9
Mississippi	58.4	53.9	64.8	63.6	53.6	55.9	67.7	72.1	73.8	66.8
Missouri	58.6	56.9	63.1	55.4	57.2	62.8	58.6	62.1	65.6	59.7
Montana	56.9	60.0	53.5	51.5	51.4	60.5	58.5	64.0	61.4	66.4
Nebraska	44.1	41.2	45.5	49.3	43.4	48.8	49.4	51.7	52.8	51.2
Nevada	70.4	71.0	59.3	73.2	69.8	74.4	68.3	67.2	[3]	[3]
New Hampshire	46.6	53.9	60.7	55.9	58.9	57.3	61.4	68.2	69.4	69.2
New Jersey	44.3	46.2	49.1	46.3	50.2	56.8	56.5	60.1	65.2	61.3
New Mexico	114.7	129.3	126.3	136.1	119.4	134.4	145.4	145.5	[3]	[3]
New York	46.8	48.0	51.9	53.6	52.8	57.4	58.8	60.8	65.0	59.4
North Carolina	68.5	68.8	77.9	66.0	66.5	72.9	78.6	79.1	85.7	79.1
North Dakota	49.6	50.4	57.3	60.0	55.5	58.8	61.7	67.2	59.5	63.4
Ohio	51.3	50.4	53.7	52.7	58.5	60.0	60.7	68.8	66.1	61.8
Oklahoma	59.9	54.6	60.5	56.4	50.0	51.5	60.7	70.2	69.0	[3]
Oregon	44.1	41.2	39.8	40.3	41.3	43.7	50.0	47.9	46.6	47.5
Pennsylvania	50.9	50.8	55.0	53.4	60.0	66.7	68.0	70.5	72.1	69.0
Rhode Island	47.1	47.2	53.9	55.5	57.2	60.8	61.8	72.0	67.2	66.5
South Carolina	80.8	79.3	83.0	78.2	77.2	81.0	88.7	91.0	96.5	[3]
South Dakota	47.3	52.5	58.0	54.8	50.4	[3]	[3]	[3]	[3]	[3]
Tennessee	68.5	64.0	73.7	69.3	67.6	67.6	75.7	77.1	80.9	71.1
Texas	69.0	71.7	71.9	75.5	[3]	[3]	[3]	[3]	[3]	[3]
Utah	52.1	49.3	49.2	47.6	44.2	51.4	57.4	59.1	58.9	54.3
Vermont	58.2	48.6	52.6	53.0	63.2	59.9	64.8	65.8	65.2	69.8
Virginia	73.8	69.6	72.6	68.5	67.2	76.3	77.3	78.8	75.9	75.5
Washington	45.6	45.2	43.2	38.8	45.2	48.3	48.7	49.0	48.1	49.8
West Virginia	71.2	60.6	67.4	68.2	75.0	77.2	81.0	77.6	70.1	71.9
Wisconsin	47.8	46.0	49.4	48.5	50.4	53.1	55.7	59.6	61.4	59.1
Wyoming	58.2	51.1	53.0	54.7	57.0	66.8	69.3	70.3	67.8	68.9

[1] 1936 figures are provisional.
[2] Not added to birth registration until a later date.
[3] Dropped from the registration area in 1925; readmitted in 1928.

DEATHS DURING WEEK ENDED JUNE 5, 1937

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended June 5, 1937	Corresponding week, 1936
Data from 86 large cities of the United States:		
Total deaths	8,129	8,316
Average for 3 prior years	8,017	
Total deaths, first 22 weeks of year	211,117	207,145
Deaths under 1 year of age	549	487
Average for 3 prior years	572	
Deaths under 1 year of age, first 22 weeks of year	13,015	12,802
Data from industrial insurance companies:		
Policies in force	69,785,134	68,357,506
Number of death claims	10,174	12,721
Death claims per 1,000 policies in force, annual rate	7.6	9.7
Death claims per 1,000 policies, first 22 weeks of year, annual rate	10.9	10.9

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 12, 1937, and June 13, 1936

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936
New England States:								
Maine	----	1	----	----	----	172	0	0
New Hampshire	1	----	----	----	75	7	0	0
Vermont	----	----	----	----	2	158	0	0
Massachusetts	3	7	----	----	634	1,084	2	5
Rhode Island	2	2	----	----	69	22	0	1
Connecticut	3	----	4	----	130	213	0	2
Middle Atlantic States:								
New York	43	41	[1] 5	[1] 3	1,586	2,546	7	13
New Jersey	6	10	5	4	1,123	430	2	3
Pennsylvania	25	15	----	----	1,727	875	7	2
East North Central States:								
Ohio	11	16	14	29	2,290	725	3	5
Indiana	4	5	15	4	379	9	2	1
Illinois	39	59	18	22	457	26	5	6
Michigan	13	6	----	1	279	75	3	3
Wisconsin	3	1	19	4	52	168	1	1
West North Central States:								
Minnesota	3	----	2	1	3	199	0	3
Iowa [2]	----	2	----	----	7	5	0	3
Missouri	7	18	23	22	56	14	1	3
North Dakota	2	----	11	----	1	3	0	0
South Dakota	1	----	----	----	2	----	1	0
Nebraska	----	1	----	3	10	19	0	1
Kansas	4	3	7	1	25	14	1	0
South Atlantic States:								
Delaware	1	1	----	----	22	10	0	0
Maryland [2 3 4]	5	6	1	1	195	333	3	3
District of Columbia	7	7	----	----	93	125	0	3
Virginia	6	9	----	----	228	81	7	4
West Virginia	6	4	17	11	39	95	3	6
North Carolina [3]	5	7	----	----	196	25	2	5
South Carolina	2	6	85	25	63	30	3	3
Georgia [3]	4	7	----	----	----	----	0	1
Florida [3]	8	----	2	7	----	11	4	1
East South Central States:								
Kentucky	6	5	1	11	198	16	5	3
Tennessee [2 3]	6	8	16	8	94	11	4	3
Alabama [3]	10	3	9	6	24	----	7	4
Mississippi [4]	1	6	----	----	----	----	1	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 12, 1937, and June 13, 1936—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936
West South Central States:								
Arkansas	3	----	7	10	6	11	1	1
Louisiana [3]	13	11	14	22	----	15	2	3
Oklahoma [4]	8	----	18	27	33	5	0	1
Texas [3]	26	25	135	78	366	125	7	0
Mountain States:								
Montana [3]	3	----	----	19	8	14	0	0
Idaho [3]	4	1	1	----	69	1	0	0
Wyoming [3 6]	1	----	----	----	21	----	0	0
Colorado [3]	3	4	----	----	21	25	0	0
New Mexico	1	2	----	1	60	56	0	1
Arizona	2	5	10	8	53	70	0	0
Utah [4]	----	----	----	----	49	19	0	0
Pacific States:								
Washington	3	----	----	----	93	199	0	1
Oregon [3]	----	1	10	----	10	63	1	0
California	31	25	63	212	273	1,135	3	5
Total	335	330	512	540	11,121	9,239	88	100
First 23 weeks of year	10,665	11,753	271,539	136,266	202,181	235,711	3,516	5,123

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936
New England States:								
Maine	0	0	13	7	0	0	1	1
New Hampshire	0	0	1	3	0	0	0	0
Vermont	0	0	1	7	0	0	0	0
Massachusetts	1	2	164	188	0	0	1	1
Rhode Island	0	0	37	23	0	0	0	2
Connecticut	0	0	91	62	0	0	1	1
Middle Atlantic States:								
New York	0	2	574	607	0	0	15	11
New Jersey	0	1	101	174	0	0	2	4
Pennsylvania	1	0	500	261	0	0	8	12
East North Central States:								
Ohio	0	0	310	270	8	0	5	8
Indiana	0	0	63	63	7	4	1	4
Illinois	1	1	392	431	15	19	5	6
Michigan	0	0	591	375	12	0	2	7
Wisconsin	0	0	189	361	2	5	2	1
West North Central States:								
Minnesota	0	0	26	150	14	3	0	3
Iowa [3]	0	0	94	126	30	19	4	9
Missouri	1	1	107	85	16	80	7	5
North Dakota	0	1	13	21	7	9	0	0
South Dakota	0	0	15	26	0	27	0	0
Nebraska	1	0	28	39	0	12	2	0
Kansas	0	0	72	131	5	8	1	53
South Atlantic States:								
Delaware	0	0	7	3	0	0	0	1
Maryland [3 4]	0	1	21	43	0	0	8	3
District of Columbia	0	0	6	11	0	0	0	0
Virginia	0	0	10	22	0	0	9	14
West Virginia	0	0	34	20	0	0	2	6
North Carolina [3]	1	2	16	15	0	0	3	4
South Carolina	2	0	----	1	0	0	16	8
Georgia [3]	2	0	3	9	0	0	11	15
Florida [3]	0	2	5	5	0	0	0	2
East South Central States:								
Kentucky	0	0	19	11	3	0	9	9
Tennessee [3]	2	0	10	15	0	0	11	12
Alabama [3]	1	1	5	5	1	0	11	4
Mississippi [4]	7	0	5	7	0	0	5	3

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 12, 1937, and June 13, 1936—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936	Week ended June 12, 1937	Week ended June 13, 1936
West South Central States:								
Arkansas	4	0	13	4	0	0	6	4
Louisiana [3]	2	2	9	----	1	1	11	13
Oklahoma [4]	3	0	9	21	1	0	11	10
Texas [3]	5	2	101	28	1	5	26	12
Mountain States:								
Montana [3]	0	0	11	49	6	12	0	1
Idaho [3]	0	0	20	5	1	0	0	2
Wyoming [3] [6]	0	0	28	11	3	3	1	0
Colorado [3]	0	0	10	49	0	0	4	0
New Mexico	0	0	32	44	0	0	0	6
Arizona	0	0	4	17	0	0	3	0
Utah [4]	0	0	15	24	0	3	0	0
Pacific States:								
Washington	0	0	25	43	0	2	0	2
Oregon [3]	0	0	30	29	7	16	1	2
California	4	2	181	261	8	0	4	10
Total	38	20	4,011	4,162	148	228	209	282
First 23 weeks of year	506	402	149,164	162,851	6,898	5,091	2,815	2,849

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended June 12, 1937, 22 cases, as follows: Iowa, 4; Maryland, 1; Tennessee, 1; Montana, 3; Idaho, 1; Wyoming, 8; Colorado, 3; Oregon, 1.
[3] Typhus fever, week ended June 12, 1937, 51 cases, as follows: Maryland, 2; North Carolina, 1; Georgia, 18; Florida, 6; Tennessee, 2; Alabama, 11; Louisiana, 1 (delayed report); Texas, 10.
[4] Week ended earlier than Saturday.
[5] Figures for 1936 are exclusive of Oklahoma City and Tulsa.
[6] Colorado tick fever, week ended June 12, 1937, Wyoming, 5 cases.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
March 1937										
Massachusetts	31	12	----	----	3,773	----	----	1,184	0	9
Michigan	11	48	15	5	332	----	1	3,992	27	14
Vermont	----	1	----	----	5	----	0	33	0	1
April 1937										
Puerto Rico	----	26	1,144	643	145	1	1	----	0	78
May 1937										
Colorado	3	21	2	----	94	----	0	140	36	3
District of Columbia	5	34	3	----	485	1	0	51	0	3
Idaho	1	4	68	2	98	----	0	84	23	8
Maine	1	3	6	----	71	----	0	97	0	4
New Mexico	1	6	4	6	344	----	0	86	3	9
West Virginia	32	25	95	----	269	2	0	278	3	10
Wyoming	1	1	----	----	7	----	----	43	14	0

March 1937

	Cases
Chicken pox:	
Massachusetts	1,471
Michigan	2,440
Vermont	1
Dysentery:	
Massachusetts (bacillary)	1
Michigan (amoebic)	1
Michigan (bacillary)	1
Encephalitis, epidemic or lethargic:	
Michigan	2
German measles:	
Massachusetts	106
Michigan	696
Vermont	5
Lead poisoning:	
Massachusetts	2
Mumps:	
Massachusetts	971
Michigan	2,247
Ophthalmia neonatorum:	
Massachusetts	111
Rabies in animals:	
Massachusetts	21
Michigan	3
Septic sore throat:	
Massachusetts	22
Michigan	60
Trachoma:	
Massachusetts	2
Trichinosis:	
Massachusetts	2
Tularaemia:	
Michigan	4
Undulant fever:	
Michigan	5
Vermont	2
Vincent's infection:	
Michigan	22
Whooping cough:	
Massachusetts	2,013
Michigan	1,226
Vermont	114

April 1937

	Cases
Puerto Rico:	
Chicken pox	48
Dysentery	27
Paratyphoid fever	1
Puerperal septicemia	4
Tetanus	15
Whooping cough	28

May 1937

Anthrax:	
West Virginia	9
Chicken pox:	
Colorado	148
District of Columbia	140
Idaho	90
Maine	281
New Mexico	63
West Virginia	132
Wyoming	39
Colorado tick fever:	
Wyoming	4
Conjunctivitis:	
Idaho	6
Dysentery:	
Idaho	2
New Mexico (amoebic)	2
Encephalitis, epidemic or lethargic:	
Idaho	2
German measles:	
Idaho	1
Maine	70
New Mexico	3
Wyoming	35
Impetigo contagiosa:	
Colorado	3
Mumps:	
Colorado	53
Idaho	78
Maine	204
New Mexico	35
West Virginia	70
Wyoming	96

May 1937—Continued

Paratyphoid fever:	
West Virginia	1
Rabies in animals:	
Maine	1
West Virginia	3
Rocky Mountain spotted fever:	
Colorado	5
Idaho	12
New Mexico	1
Wyoming	15
Septic sore throat:	
Colorado	1
Idaho	8
New Mexico	5
Wyoming	3
Tetanus:	
Maine	2
Trachoma:	
Idaho	1
Tularaemia:	
West Virginia	1
Wyoming	1
Typhus fever:	
Colorado	3
Undulant fever:	
Idaho	1
Maine	1
New Mexico	1
West Virginia	1
Vincent's infection:	
Idaho	2
Maine	10
Whooping cough:	
Colorado	157
Idaho	80
Maine	235
New Mexico	93
West Virginia	374
Wyoming	15

CASE OF HUMAN PLAGUE IN DOUGLAS COUNTY, NEV. (PROVISIONAL DIAGNOSIS)

Under date of June 4, 1937, Surg. C. R. Eskey states that a provisional laboratory diagnosis of plague has been made in a patient who had been living at Lake Tahoe, Douglas County, Nev., about 6 miles from the cottage of a patient who developed plague last year.[1]

[1] PUBLIC HEALTH REPORTS, Oct. 2, 1936, p. 1392.

CASES OF VENEREAL DISEASES REPORTED FOR APRIL 1937

These reports are published monthly for the information of health officers in order to furnish current data as to the prevalence of the venereal diseases. The figures are taken from reports received from State and city health officers. They are preliminary and are therefore subject to correction. It is hoped that the publication of these reports will stimulate more complete reporting of these diseases.

Reports from States

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Alabama	1,166	4.11	390	1.38
Arizona	56	1.45	97	2.51
Arkansas	471	2.36	283	1.42
California	1,920	3.40	1,640	2.91
Colorado	124	1.17	56	.53
Connecticut [1]	190	1.11	105	.61
Delaware	203	7.93	49	1.91
District of Columbia	188	3.16	162	2.73
Florida	68	.42	29	.18
Georgia	1,424	4.26	416	1.24
Idaho	53	1.11	51	1.06
Illinois	2,254	2.88	1,263	1.62
Indiana	215	.63	127	.37
Iowa	10	.04	9	.04
Kansas	152	.82	77	.42
Kentucky [2]				
Louisiana	205	.97	143	.67
Maine [2]				
Maryland [1]	830	4.97	237	1.42
Massachusetts	560	1.28	453	1.04
Michigan	794	1.70	586	1.26
Minnesota	365	1.39	264	1.00
Mississippi	1,900	9.69	2,382	12.15
Missouri	171	.44	102	.26
Montana [2]				
Nebraska	52	.38	55	.40
Nevada [2]				
New Hampshire	9	.18	8	.16
New Jersey	669	1.56	230	.54
New Mexico	136	3.38	57	1.42
New York	8,192	6.36	1,731	1.34
North Carolina	2,102	6.15	456	1.33
North Dakota	30	.43	42	.60
Ohio [1]	1,071	1.60	243	.36
Oklahoma [1]	441	1.76	251	1.00
Oregon	73	.72	186	1.85
Pennsylvania [4]	1,353	1.34	176	.17
Rhode Island	79	1.16	71	1.04
South Carolina [1]	463	2.30	458	2.28
South Dakota	64	.95	25	.37
Tennessee	897	3.09	238	.82
Texas	170	.28	28	.05
Utah [2]				
Vermont	27	.72	17	.45
Virginia [1]	566	2.15	226	.86
Washington	313	1.92	384	2.35
West Virginia [2]				
Wisconsin [4]	29	.10	117	.40
Wyoming [2]				
Total	30,055	2.49	13,920	1.15

See footnotes at end of table.

Reports from cities of 200,000 population or over

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Akron, Ohio [1]				
Atlanta, Ga.	161	5.61	114	3.97
Baltimore, Md.	475	5.76	149	1.81
Birmingham, Ala.	166	5.88	79	2.80
Boston, Mass.	220	2.78	183	2.31
Buffalo, N. Y.	261	4.41	102	1.72
Chicago, Ill.	1,169	3.28	813	2.28
Cincinnati, Ohio [2]				
Cleveland, Ohio	245	2.63	80	.86
Columbus, Ohio	81	2.65	17	.56
Dallas, Tex. [3]				
Dayton, Ohio [3]				
Denver, Colo.	107	3.61	53	1.79
Detroit, Mich. [3]				
Houston, Tex. [4]	170	5.08	28	.84
Indianapolis, Ind. [3]				
Jersey City, N. J. [3]				
Kansas City, Mo.	48	1.14	15	.36
Los Angeles, Calif.	510	3.56	500	3.49
Louisville, Ky. [3]				
Memphis, Tenn.	238	8.91	67	2.51
Milwaukee, Wis. [3]				
Minneapolis, Minn.	93	1.91	93	1.91
Newark, N. J.	260	5.61	132	2.83
New Orleans, La. [3]				
New York, N. Y.	7,626	10.44	1,273	1.74
Oakland, Calif. [3]				
Omaha, Nebr.	16	.73	8	.36
Philadelphia, Pa. [3]				
Pittsburgh, Pa.	76	1.11	38	.56
Portland, Oreg. [3]				
Providence, R. I.	46	1.78	37	1.43
Rochester, N. Y.	36	1.07	59	1.75
St. Louis, Mo.	178	2.13	122	1.46
St. Paul, Minn.	63	2.23	41	1.45
San Antonio, Tex.	63	2.51	188	7.48
San Francisco, Calif.	261	3.89	172	2.56
Seattle, Wash.	137	3.61	136	3.58
Syracuse, N. Y.	87	3.99	56	2.57
Toledo, Ohio	88	3.89	37	1.22
Washington, D. C. [5]	188	3.16	162	2.73

[1] Incomplete.
[2] No report for current month.
[3] Not reporting.
[4] Only cases of syphilis in the infectious stage are reported.
[5] Reported by Jefferson Davis Hospital; physicians are not required to report venereal disease.
[6] Reported by the Social Hygiene Clinic.

WEEKLY REPORTS FROM CITIES

City reports for week ended June 5, 1937

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	191	95	31	5,649	524	1,871	16	414	37	1,358	----
Current week [1]	128	40	36	4,033	488	1,637	23	376	21	1,193	----
Maine:											
Portland	0	----	0	4	3	0	0	0	0	0	23
New Hampshire:											
Concord	0	----	0	2	0	0	0	0	0	0	10
Manchester	----	----	----	----	----	----	----	----	----	----	----
Nashua	0	----	0	0	1	2	0	0	0	0	6

[1] Figures for Barre, Vt., and Newark, N. J., estimated; reports not received.

City reports for week ended June 5, 1937—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Vermont:											
Barre											
Burlington	0		0	0	0	1	0	0	0	0	12
Rutland	0		0	1	2	1	0	0	0	0	6
Massachusetts:											
Boston	1		1	50	15	64	0	6	0	33	218
Fall River	0		1	29	2	0	0	1	0	2	35
Springfield	0		0	1	1	2	0	3	0	9	33
Worcester	0		0	17	7	4	0	2	0	17	
Rhode Island:											
Pawtucket	0		0	0	0	0	0	0	0	0	20
Providence	0		1	57	3	30	0	4	0	41	77
Connecticut:											
Bridgeport	0		0	3	1	52	0	0	0	1	28
Hartford	0		0	36	2	7	0	3	0	3	
New Haven	0		0	4	1	3	0	1	0	1	21
New York:											
Buffalo	0		0	115	5	18	0	11	0	24	165
New York	31	6	6	877	84	249	0	77	4	72	1,440
Rochester	1		0	12	5	6	0	1	0	17	68
Syracuse	0		0	22	2	15	0	0	0	16	47
New Jersey:											
Camden	0	1	0	30	1	3	0	0	0	2	36
Newark											
Trenton	0		0	29	3	5	0	0	0	1	38
Pennsylvania:											
Philadelphia	0	4	3	42	17	157	0	27	2	36	467
Pittsburgh	2	2	2	261	11	35	0	4	0	36	160
Reading	0		1	116	1	4	0	1	0	2	35
Scranton	0			0		4	0		0	0	
Ohio:											
Cincinnati	1		0	79	6	13	0	8	0	13	122
Cleveland	2	4	0	516	24	73	0	16	0	35	196
Columbus	0		0	23	6	6	0	1	0	22	58
Toledo	0	1	1	338	2	0	0	6	0	37	57
Indiana:											
Anderson	0		0	21	2	5	0	0	0	2	11
Fort Wayne	0		0	0	2	0	0	2	0	0	22
Indianapolis	1		1	314	10	9	2	6	0	20	118
Muncie	0		0	0	2	0	0	0	0	0	14
South Bend	0		0	0	0	3	0	0	0	1	15
Terre Haute	1		0	0	0	4	4	0	0	0	10
Illinois:											
Alton	0		0	1	0	3	0	0	1	3	8
Chicago	30	4	3	326	40	229	0	37	1	56	677
Elgin	0		0	0	2	3	0	0	0	7	9
Moline	0		0	0	0	3	14	0	0	9	3
Springfield	0		0	19	2	0	0	1	0	3	11
Michigan:											
Detroit	8		3	98	33	265	2	19	0	60	269
Flint	0		0	29	2	18	0	1	0	1	23
Grand Rapids	1		0	62	3	9	0	1	0	27	41
Wisconsin:											
Kenosha	0		0	0	1	6	0	0	0	1	12
Madison	0		0	1	0	4	0	0	0	2	12
Milwaukee	0		0	19	7	31	0	6	0	22	113
Racine	0		0	0	0	6	0	0	0	0	10
Superior	1		0	0	0	0	0	0	0	0	10
Minnesota:											
Duluth	1		0	0	2	25	0	0	0	0	26
Minneapolis	1		0	1	4	5	0	1	0	11	98
St. Paul	0		0	4	6	5	0	0	0	71	69
Iowa:											
Cedar Rapids	0			0		4	1		0	0	
Davenport	0			0		2	1		0	0	
Des Moines	0			0		18	1		0	0	33
Sioux City	0			0		7	0		0	1	0
Waterloo	0			1		7	0		0	0	
Missouri:											
Kansas City	2		1	2	2	30	0	3	0	9	79
St. Joseph	0		0	0	2	6	1	0	0	3	24
St. Louis	3		0	27	6	80	0	9	3	44	200
North Dakota:											
Fargo	0		0	0	0	1	0	0	0	7	11
Grand Forks	0			0		0	1		0	8	
Minot	0		0	0	0	0	4	0	0	0	2
South Dakota:											
Aberdeen	0			0		2	0		0	0	

City reports for week ended June 5, 1937—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Nebraska:											
Omaha	0	------	0	0	2	6	0	2	0	10	51
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	3
Topeka	0	------	0	0	4	2	0	0	0	4	16
Wichita	1	------	0	6	3	0	0	0	0	7	18
Delaware:											
Wilmington	0	------	0	0	3	1	0	1	0	0	26
Maryland:											
Baltimore	2	------	2	135	21	14	0	16	0	55	219
Cumberland	0	------	0	0	0	0	0	0	0	6	10
Frederick	0	------	0	0	0	0	0	0	0	0	2
Dist. of Columbia:											
Washington	8	1	1	110	7	3	0	11	2	15	169
Virginia:											
Lynchburg	0	------	0	4	1	1	0	0	0	14	11
Norfolk	0	------	0	15	4	0	0	0	0	0	27
Richmond	1	------	0	0	4	4	0	3	1	0	46
Roanoke	0	------	0	52	2	1	0	1	0	0	20
West Virginia:											
Charleston	0	1	0	0	1	0	0	0	1	0	15
Huntington	1	------	--------	0	-------	1	0	-------	0	0	--------
Wheeling	1	------	1	2	3	0	0	1	0	11	17
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	2	--------
Raleigh	0	------	0	1	1	1	0	0	0	1	18
Wilmington	0	------	0	0	1	0	0	0	0	0	12
Winston-Salem	0	------	0	1	0	1	0	0	0	9	12
South Carolina:											
Charleston	0	------	0	1	5	0	0	3	0	0	21
Florence	0	------	0	0	0	0	0	0	0	0	9
Greenville	0	------	0	0	0	0	0	0	1	1	7
Georgia:											
Atlanta	0	3	1	0	3	4	0	6	1	15	80
Brunswick	0	------	0	0	1	0	0	0	0	0	3
Savannah	0	------	0	0	2	0	0	1	0	8	30
Florida:											
Miami	0	1	1	0	0	1	0	5	0	0	44
Tampa	1	------	0	21	1	3	0	0	1	6	24
Kentucky:											
Covington	0	------	0	54	2	3	0	3	0	3	18
Lexington	0	------	0	20	2	1	0	2	0	21	23
Louisville	0	4	0	59	5	28	0	4	0	69	75
Tennessee:											
Knoxville	0	------	1	0	5	0	0	1	0	0	35
Memphis	0	------	0	57	5	1	0	5	0	34	92
Nashville	0	------	0	8	11	0	0	0	0	12	61
Alabama:											
Birmingham	1	4	0	20	6	1	0	3	0	9	75
Mobile	0	------	0	0	3	0	0	1	0	1	26
Montgomery	0	4	--------	0	-------	1	0	-------	0	0	--------
Arkansas:											
Fort Smith	1	------	--------	0	-------	4	0	-------	0	0	--------
Little Rock	0	------	0	0	2	0	0	0	0	0	--------
Louisiana:											
Lake Charles	0	------	0	1	0	0	0	0	0	0	8
New Orleans	7	2	0	6	11	11	0	10	0	0	147
Shreveport	0	------	0	0	3	1	0	1	1	0	55
Oklahoma:											
Muskogee	0	------	--------	0	-------	0	0	-------	0	0	--------
Oklahoma City	1	------	0	8	4	4	0	0	1	2	43
Tulsa	0	------	--------	3	-------	1	0	-------	0	11	--------
Texas:											
Dallas	0	2	2	31	2	3	0	2	0	26	53
Fort Worth	0	------	0	0	2	5	0	4	1	23	35
Galveston	0	------	0	3	3	0	0	2	0	0	18
Houston	3	------	0	2	3	3	0	3	2	0	64
San Antonio	0	------	1	0	10	0	0	10	0	0	94
Montana:											
Billings	0	------	0	0	1	0	0	0	0	2	12
Great Falls	0	------	0	0	1	0	5	0	0	1	5
Helena	0	------	0	0	0	2	0	0	0	1	5
Missoula	0	------	0	0	2	0	5	0	0	0	9
Idaho:											
Boise	0	------	0	0	0	0	0	0	0	0	11

City reports for week ended June 5, 1937—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Colorado:											
Colorado Springs	0	------	0	1	3	1	0	0	0	0	12
Denver	0	------	1	16	5	4	1	2	0	21	80
Pueblo	0	------	0	0	0	0	0	0	0	0	13
New Mexico:											
Albuquerque	0	------	0	4	1	2	0	0	0	2	12
Utah:											
Salt Lake City	0	------	1	78	3	7	0	1	0	8	34
Washington:											
Seattle	2	------	0	10	2	2	0	3	1	38	79
Spokane	1	------	0	35	1	6	0	0	0	5	34
Tacoma	1	------	0	0	1	6	0	0	0	1	27
Oregon:											
Portland	0	------	0	2	6	13	0	2	0	3	81
Salem	0	1	--------	0	--------	0	0	--------	0	7	--------
California:											
Los Angeles	9	5	2	30	6	35	3	22	1	89	250
Sacramento	1	------	0	34	1	2	0	1	0	9	27
San Francisco	1	------	0	10	9	17	0	7	0	42	158

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				West Virginia:			
Boston	1	1	0	Huntington	1	0	0
Fall River	0	1	0	Wheeling	1	0	0
Rhode Island:				Florida:			
Providence	1	0	0	Miami	1	1	0
New York:				Tennessee:			
New York	4	0	1	Memphis	1	0	0
Rochester	0	0	1	Nashville	1	0	0
Pennsylvania:				Alabama:			
Philadelphia	1	0	0	Birmingham	2	1	0
Pittsburgh	0	1	0	Mobile	1	0	0
Ohio:				Arkansas:			
Cincinnati	1	1	0	Little Rock	0	1	0
Michigan:				Louisiana:			
Detroit	1	0	0	Shreveport	0	2	0
Missouri:				Texas:			
St. Louis	1	0	0	Houston	1	0	0
Nebraska:				San Antonio	1	0	0
Omaha	0	0	2	California:			
Maryland:				Los Angeles	0	1	2
Baltimore	3	2	0	Sacramento	1	0	0
District of Columbia:							
Washington	4	3	0				

Dengue.—Cases: San Francisco, 1.

Encephalitis, epidemic or lethargic.—Cases: Toledo, 1; Lawrence, 1; Baltimore, 1.

Pellagra.—Cases: Washington, 1; Charleston, S. C., 1; Savannah, 1; Miami, 1; Birmingham, 2; Montgomery, 2; New Orleans, 2; San Francisco, 1.

Rabies in man.—Deaths: Philadelphia, 1; Mobile, 1.

Typhus fever.—Cases: New York, 1; Springfield, Ill., 1; Savannah, 1; Mobile, 1; Galveston, 1. Deaths: Springfield, Ill., 1.

FOREIGN AND INSULAR

EGYPT

Infectious diseases—Third quarter, 1936.—During the third quarter of 1936, certain infectious diseases were reported in Egypt as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Cerebrospinal meningitis	------	19	Plague	4	1
Chicken pox	52	3	Poliomyelitis	3	3
Diphtheria	496	252	Puerperal septicemia	128	101
Dysentery	1,089	178	Rabies	8	8
Erysipelas	949	230	Scarlet fever	7	------
Influenza	2,653	82	Tetanus	97	75
Leprosy	20	13	Tuberculosis (pulmonary)	1,226	637
Lethargic encephalitis	3	------	Typhoid fever	1,967	450
Malaria	5,242	35	Typhus fever	112	31
Measles	2,365	1,006	Undulant fever	1	------
Mumps	214	13	Whooping cough	671	88

Vital statistics—Third quarter, 1936.—Following are vital statistics for the third quarter of 1936 in all places in Egypt having a health bureau:

Population	4,710,500
Live births	50,227
Births per 1,000 population	42.6
Stillbirths	1,087
Total deaths	42,015
Deaths per 1,000 population	35.7
Deaths from diarrhea and enteritis under 2 years of age	14,789
Infant mortality per 1,000 births	292

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan-American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following table must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths, P, present]

Place		Nov. 1–28, 1936	Nov. 29–Dec 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Jan. 31–Feb. 27, 1937	Week ended— March 1937 6	13	20	27	April 1937 3	10	17	24	May 1937 1	8	15	22	29
India	C	23,017	17,965	20,182	7,736	2,091	2,560	4,295	4,069	5,186	5,386							
	D	11,747	9,506	11,282	4,305	1,098	1,301	2,045	2,044	2,395	2,683							
Assam	C	710	664	585	197	62	64	101	167	236	402	446	739	706	554	503	481	310
	D	318	315	330	80	24	26	42	69	99	138	186	305	289	255	206	248	147
Bassein	C				8	3	9	17	8	8	9	21	48	46	34		4	1
Bombay Presidency	C	2,389	2,367	646	253	28	27	19	24	35	132	164	226	256	613	687		
	D	1,120	1,467	249	142	14	14	7	9	13	57	76	91	121	282	338		
Bombay	C		2									[1] 1		[1] 1				
Calcutta	C	61	61	88	87	16	21	35	34	44	37	49	117	94	136	136	231	135
Central Provinces and Berar	C	922	567	125		2	1	1					5	5	17	23	21	17
Chittagong	C	16	11	3	2				3		1	6	6	[1] 1	16	32	43	51
Madras Presidency	C	10,204	5,588	10,652	4,516	505	689	1,302	690		1,181	1,028	1,061		291	212		
	D	5,161	2,885	5,712	2,514	262	326	610	361		635	572	648		173	117		
Madras	C	57	60	75	25		1	2	2	2	2	1						1
	D	12	21	41	14			1			1							
Negapatam	C		11	22	4	1			1							1		1
	D		7	13	1													
Northwest Frontier Province	C	84	7															
Orissa Province	C	155	994	889	609	137	137	148	180		137	157	74	91	38	29	15	8
Punjab	C	7						1				1	1	2			1	
Rangoon	C	4	2	1	4	2	1				2		4	4	4		1	3
Sind State	C															1		
Tuticorin	C	12	3											[1] 2				
India (French):																		
Chandernagor Territory	C		5	9					3	2	2							
Karikal Province	C	4	96	96	16			2	1									
Pondichery Province	C	10			13	1												
Indochina (see also table below): Cochinchina—																		
Chaudoc	C						P											
Cholon Province	C			1								P						
Vinlong	C		1															
Philippine Islands: Manila	C												1					
	D												1					

Place		December 1936			January 1937			February 1937			March 1937			April 1937			May, 1–10, 1937
		1–10	11–20	21–31	1–10	11–20	21–31	1–10	11–20	21–28	1–10	11–20	21–31	1–10	11–20	21–30	
Siam:																	
Bangkok	C	2	150	163	37	39	57	93	125	167	305	351	178	84	33	23	20
Provinces	C	196	855	1,339	275	265	465	480	301	500	448	397	286	213	146	104	47
On vessels:																	
S. S. *Kedah* at Singapore from Penang	C									1							
S. S. *Hellas* at Bangkok from Swatow	C										3						
	D										2						
S. S. *Kedah* at Belawan-Deli	C									1							
S. S. *Ellenga*.[1]																	
Indochina (French) (see also table above):																	
Cambodia [2]	C	1									2	6			2		8
	D	1									2	6			2		1
Cochinchina [2]	C		1				1				2				1		
	D		1				1				2				1		

[1] Imported.
[2] During the week ended June 5, 1937, 6 deaths from cholera were reported on the S. S. *Ellenga* at Penang from Negapatam.
[3] Reports incomplete.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE[1]

[C indicates cases; D, deaths; P, present]

Place		Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Jan. 31–Feb. 27, 1937	Week ended— March 1937 6	13	20	27	April 1937 3	10	17	24	May 1937 1	8	15	22	29
Algeria: Algiers	C		[2] 1															
Argentina. (See table below.)																		
Bolivia. (See table below.)																		
Brazil. (See table below.)																		
British East Africa:																		
Kenya	C	18	8	20	7	2	1	1			3		2					
Tanganyika	C				84			4	6	8	5	16		1				
Uganda	C	85	52	36	32	5	12	7	17	6	6	7	5	5				
	D	76	50	34	32	4	8	6	17	5	5	7	5	3				
Ceylon:																		
Chilaw District	C																	1
Colombo	C	4	3	3	10	3	1		2					1			1	
	D	3	3	3	9	3	1		2					1			1	
Plague-infected rats		1	4	12	17	2		1			1		1	1				
China:																		
Amoy	C									1	[3] 1							
Fukien Province[4]	D									130								
Hainan Island	C								P									
Hsiatangchi[5]																		
Dutch East Indies:																		
Java and Madura	C	317	452	583	568	107	119											
	D	315	452	577	569	107	119											
Java—Batavia	C										[6] 1							
Ecuador (see also table below):																		
Babahoyo	C	5	2	3	1													
Plague-infected rats		6																
Bajada del Morro	C	4																
Guayaquil	C	21	13	17	26	7	5	9	12	5	4	7	1	5	3			
	D	14	13	11	11	6	4	6	8	5	4	6	1	2		1		
Plague-infected rats		7	8	10	16	8	7	5	18	13	7	9	8	4	5	10	8	
Playas	C		11	1														
Egypt:																		
Alexandria: Plague-infected rats		P																
Asyut Province	C	1	2	2	1				2	16	18	10	4	7	1	1		
Dakahliya Province	C										1							
Girga Province	C	1				1				1				2		1		

Formosa: Taihoku District	C		1															
Hawaii Territory: Plague-infected rats:																		
Hawaii Island—Hamakua District:																		
Hamakua Mill Sector								1										
Kukaiau				1														
Paauhau Sector [7]		3	5	9	6	1	2	2			1	1	2	2		2		
Pohakea								1										
India	C	2,335	3,029	5,118	4,931	1,843	1,563	1,405	1,169	1,368	1,787	1,639						
	D	717	1,099	2,006	2,528	825	838	701	612	762	946	926						
Bassein	C	1	1	3	7	2	1	2		1		2	5	2		4		1
Plague-infected rats					1	1			1		1	1				2		
Bombay Presidency	C	57	105	139	120	31	19	19	14	30	22	9	7	19	5	4		
	D	35	50	86	62	15	8	8	9	18	10	8	1	8	4	1		
Central Provinces and Berar	C	1,376	1,592	2,022	1,614	806	458	527	422	388	317	213	185	182	71	58	39	13
Karachi	C				7			1	2	2		3		1				
Plague-infected rats													1					
Madras Presidency	C	29	131	97	94	23	32	24	18	30	16	5	2		4	1		
	D	15	80	55	57	8	17	17	12	16	8	6			1			
Punjab	C						1						1	1	1			
Rangoon	C			3	1	1				2	1			1			1	
Sind State	C				6	1	1	2		2	1	3		1		1		
Indochina (see also table below): Bentre	C			1														
Madagascar. (See table below.)																		
Malta	C	6		6									1				1	
	D			1														
Plague-infected rats				1														
Northern Rhodesia	C			8	1													
Peru. (See table below.)																		
Senegal:																		
Dakar	C										1							
Thies	C															2		
Tivaouane	C													1				
Syria: Ras el Ain region. [8]																		
Tunisia: Tunis	C	1	1														1	
Plague-infected rats			3	1								1	16		5			
Union of South Africa (see also table below)	C	3	5	[9] 2	4				[9] 3		[9] 1							

[1] Including plague in the United States and its possessions.
[2] Suspected.
[3] Imported, pneumonic plague.
[4] Under date of June 1, estimated deaths from plague in Province of Fukien, China, reported to be 3,000 to 4,000.
[5] Information dated May 10, states that several hundred deaths from bubonic plague had been reported in Hsiatangchi, China.
[6] Imported.
[7] During the week ended June 19, 1937, 2 plague-infected rats were reported in Paauhau Sector, Hamakua District, Island of Hawaii, Hawaii Territory.
[8] During the week ended June 5, 1937, 12 cases of pneumonic plague with 12 deaths were reported in Ras el Ain region, Syria.
[9] For 2 weeks.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

Place	Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Jan. 31–Feb. 27, 1937	Week ended— March 1937 6	13	20	27	April 1937 3	10	17	24	May 1937 1	8	15	22	29
United States:																	
California: San Bernardino County.[10]																	
Nevada: Douglas County.[11]																	
Oregon: [12]																	
Grant County—Plague-infected ground squirrel															1		
Lake County—Plague-infected fleas.[13]																	
Wallowa County—Plague-infected ground squirrel																	1
Washington: Adams County—Plague-infected fleas and lice.[13]																	
On vessel: S. S. *Magister* at Kingston from Maranhao, Para, and Manaos	C							1									

[10] According to information dated Nov. 10, one lot of 31 fleas taken from 24 Fisher squirrels shot in Holcomb Valley in San Bernardino County, has been proved positive for plague by animal inoculation.
[11] During the week ended June 5, 1937, 1 case of plague (provisional diagnosis) was reported in Douglas County, Nev.
[12] During the week ended May 8, plague-infection in a lot of 56 fleas taken from 36 ground squirrels in Lake County, Oreg., was proved by animal inoculation.
[13] During the week ended May 1, plague-infection in a lot of 33 fleas and 3 lice from 21 ground squirrels and in a lot of 18 fleas and 5 lice from 13 ground squirrels in Adams County, Wash., was proved by animal inoculation.

Place		November 1936	December 1936	January 1937	February 1937	March 1937	April 1937
Argentina:							
Cordoba Province	C	4	5	----	----	1	----
Salta Province	C	----	----	2	----	----	----
San Luis Province	C	----	1	----	----	----	----
Bolivia:							
Chuquisaca Department	C	----	----	P	5	----	[14] 2
Oruro Department	C	----	----	----	----	----	[14] 1
Potosi Department	C	----	----	----	----	[14] 3	[14] 1
Brazil:							
Ceara State	C	----	----	1	----	----	----
Parahyba State	C	----	----	4	1	----	----
Pernambuco State	C	----	----	----	2	----	----
Ecuador (see also table above):							
Manabi—							
Bahia	C	----	----	----	4	7	2
Manta	C	----	----	----	8	12	13
Indochina (see also table above):							
Cambodia	C	----	1	----	----	1	4
Cochinchina	C	----	1	1	----	----	----
Madagascar (central region)	C	186	176	[16]170	[16] 219	----	57
	D	174	167	161	199	----	57
Peru	C	33	16	23	23	28	9
Cajamarca Department	C	9	----	----	----	1	----
Huancabamba Department	C	----	----	----	----	----	3
Lambayeque Department	C	3	1	2	4	----	1
Libertad Department	C	19	14	15	12	12	4
Lima Department	C	2	1	4	5	1	1
Lima City	C	----	----	----	1	----	----
Piura Department	C	----	----	2	2	14	----
Union of South Africa (see also table above)	C	5	2	2	3	3	----

[14] Pneumonic plague.
[15] Includes 44 cases of pneumonic plague.
[16] Includes 66 cases of pneumonic plague.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX

[C indicates cases; D, deaths; P, present]

Place		Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Jan. 31–Feb. 27, 1937	Week ended— March 1937 6	13	20	27	April 1937 3	10	17	24	May 1937 1	8	15	22	29
Algeria:																		
Algiers Department	C			2											1			
Oran Department	C					2									3			
Southern Territories	C									2								
Angola. (See table below.)																		
Argentina. (See table below.)																		
Belgian Congo. (See table below.)																		
Bolivia. (See table below.)																		
Brazil:																		
Bahia	C	38	20	14	7	1	2	1	2	3	4	2	6					
Porto Alegre (alastrim)	D		1	1								1	2					
Recife (alastrim)	C	3	15		1	3				1								
Rio de Janeiro	C			3														
British East Africa: Tanganyika	C	207	4	382	122	6	49				55		17	65				
Canada:																		
Alberta	C	4	[1]4	2	[1]46						[1]1							
British Columbia	C			[1]1														
Manitoba	C								[1]1									
Saskatchewan	C				[1]1													
Ceylon: Colombo	C				1													
China:																		
Amoy	C			3				1	2	1		1		1				
Canton	C		2		4		3				3	1			1			
Dairen	C		1	2	6			1	3									
Foochow	C	P	P	P	P	P		P		P		P		P		P		
Hangchow	C		1	5	3			1			1	2						
Hankow	C		5	7	5	1	1	4	2	2	3	5	1	1				
Hong Kong	C			7	5	2	1	1	3	6	18	5	3	7	4	1		4
Macao	C					1		1										
Nanking	C	1	3	2	7	1	1	3	2	1	2							
Shanghai	C	24	98	231	127	25	32	25	14	14	11	11	19	8	11		12	13
Swatow	C						[1]1	1	1	1	1		2					
Tientsin	C	1	4	2	11		1		4		2	1		1				
Chosen. (See table below.)																		
Colombia: Barranquilla	D	3	7	1	3				2	1								

Dahomey. (See table below.)																			
Dutch East Indies: Java—Surabaya	C			[1]1															
Ecuador: Guayaquil	C	8		10	33	23	24	12	14	7	11	7	9	4	6	9	12		
Egypt:						[2]6													
Alexandria	C	[1]1											4						
Port Said	C								1										
Qena Province	C				3	102			1		2	1	3						
Eritrea (see also table below)	C																		
Estonia	C	13																	
Ethiopia																			
Finland. (See table below.)																			
France. (See table below.)																			
Gambia:							[1]4												
Bathurst	C						4												
MacCarthy Island	C																		
Great Britain: England and Wales—																			
Derby	C						1	1											
Lancaster—Failsworth	C			2															
London and Great Towns (Oldham)	C	1	7																
Ripley	C						1												
Greece: Salonika	C	34	38	10	15		6	6	6	6	8	8	8	8					
Guatemala. (See table below.)																			
Honduras: Puerto Castilla	C											1							
India		3,559	4,605	10,849	13,761	3,439	3,018	3,358	2,777	3,539	3,450	2,410							
	D	868	1,136	2,740	3,219	894	755	741	615	726	826	494							
Assam	C	36	154	212	220	49	51	29	34	64	51	42	47	88	91	75	66	64	
Bassein	C			18															
Bombay Presidency	C	116	170	671	905	145	195	242	200	200	244	251	452	318	286	153			
	D	27	30	99	146	23	38	37	38	39	44	45	70	60	30	35			
Bombay	D	3	7	25	49	13	16	9	25	38	21	33	44	40	34	21	40	30	
	C	3	3	17	29	10	14	6	18	19	13	18	18	28	19	14	28	16	
Calcutta	D	8	9	29	86	23	21	21	22	17	15	17	8	22	37	20	18	9	
	C	2	7	12	34	21	18	13	16	14	16	10	11	16	2	14	11	4	
Central Provinces and Berar	D	38	115	235	299	76	64	124	77	136	136	124	109	130	136	45	84	57	
Chittagong	C	[2]2	10	237	208	24	11	13	7	5	[1]1	5	1	1					
Cochin	C										47			1				2	
Karachi	C	[1]1	8	40	49	20	11	7	2	17	1	5	5	12	2	3		2	
Madras Presidency	C	298	161	671	579	236	106	175	115	161	109	140	159		46	27			
	D	59	37	131	84	29	30	41	18	26	16	25	22		8	8			
Madras	D	3	7	3	37	8	3	5	8	7	5		12	9	11	10	12	7	
Moulmein	C	12	31	48	64	16	8	12	12	3	2	1	2						
Northwest Frontier Province	C	15	57	125	85	11	15	15	14	11	10	9	19	15	5	1		9	
Orissa Province	C		376	681	1,049	186	257	233	172	166	204	131	265	126	150	172		170	
Punjab	C	294	499	533	490	249	156	75	72	77	111	107	105	127	55	138	111		
Rangoon	C	11	2	5	14		2	1	2	5	[1]1	2	1	1		1		1	
Sind State	C	52	180	195	184	38	28	77		36	96	38	93	3	58	31		96	
Vizagapatam	C				3	1													
India (French): Chandernagor Territory	C						2												
India (Portuguese)	C		2																

[1] For 2 weeks.
[2] Imported.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

Place		Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Jan. 31–Feb. 27, 1937	Week ended— March 1937 6	13	20	27	April 1937 3	10	17	24	May 1937 1	8	15	22	29
Indochina (see also table below):																		
Pnom-Penh	C	5	1								1						1	
Saigon-Cholon	C			2	2													
Tourane	C			3	3		2		2	1	1	1						
Iran	C	1	1	11	10						2							
Teheran	C	2	1		2		1	1							1			
Iraq	C	6	30	1	1					6			8	1			1	
Baghdad	C													1				
Japan:																		
Kobe	C								[2] 1									
Moji	C							1		2		6	2	1		1	1	
Osaka	C												1					
Tokyo	C	1																
Yokohama	C				1							1						
Mexico (see also table below):																		
Chihuahua	C				3													
Durango	D		1	2	1	4	2	1	3	2		4	2	2	2			1
Guadalajara	D											1			1			1
Mexico, D. F	C	2	2	7	4													
Monterrey	C			2	11	1				3								1
San Luis Potosi	D															1		
Torreon	C	2	3	31	7				1	2	2	5	2		3	6	12	1
Morocco. (See table below.)																		
Nicaragua: Puerto Cabezas	C				2													
Nigeria	C	12	[1] 11	300	19	[3] 321	85						188					
Lagos	C				1							1						
Northern Rhodesia	C	91																
Nyasaland. (See table below.)																		
Palestine. (See table below.)																		
Peru. (See table below.)																		
Poland	C				1													
Portugal (see also table below):																		
Lisbon	C			2	1	1		1				1				1		
Oporto	C			1	1													

Siam: Tak Province	C				26				1		4	1	2						
Sierra Leone	C	16	38	88	12														
Freetown	C		3		1														
Southern Rhodesia	C		10								1								
Sudan (Anglo-Egyptian)	C	113	116	37	75	1	1	5	5			1	1	7	3		1	2	
Tunisia	C			1	105														

[1] For 2 weeks.

[2] Imported.

[3] For 4 weeks.

On vessels:

S. S. *Jaldurga* at Rangoon from Gopalpur	1 case	Dec.	30, 1936
S. S. *Egra* at Rangoon from Calcutta	1 case	Jan.	4, 1937
S. S. *Tango Maru* at Singapore from Japan	1 death	Jan.	16, 1937
S. S. *Juna* at Rangoon from Penang	1 case	Jan.	27, 1937
S. S. *Horai Maru* at Moji from Keelung	2 cases	Jan.	28, 1937
S. S. *Tjibadak* at Surabaya from Shanghai	1 case	Jan.	28, 1937
S. S. *Colorado Springs* at Manila from Shanghai	1 case	Feb.	1, 1937
S. S. *Nikko Maru* at Moji from Tsingtao	1 case	Feb.	7, 1937
S. S. *Bhadravati* at Bombay from Venguria	1 case	Feb.	18, 1937
S. S. *Nagasaki Maru* at Nagasaki from Shanghai	1 case	Mar.	8, 1937

On vessels:

S. S. *Kiangsu* at Swatow from Bangkok	1 case	Mar.	13, 1937
S. S. *Sumatra* at Calcutta	2 cases	Mar.	21, 1937
S. S. *Englestan* at Rangoon from Chittagong	1 case	Mar.	25, 1937
S. S. *Daviken* at Hong Kong	1 case	Mar.	31, 1937
S. S. *Talma* at Hong Kong	1 case	Apr.	1, 1937
S. S. *Jalagopal* at Rangoon from Chittagong	1 case	Apr.	2, 1937
S. S. *Taksang* at Hong Kong	1 case	Apr.	13, 1937
S. S. *President Hoover* at Yokohama from Honolulu	1 case	Apr	17, 1937
S. S. *Hydri* at Karachi	1 case	Apr.	24, 1937
S. S. *C. G. Pasquier* at Singapore from Saigon	1 case	May	7, 1937

Place		November 1936	December 1936	January 1937	February 1937	March 1937	April 1937
Angola	C	25	24				
Argentina:							
Corrientes Province	C		1				
Entre Rios Province	C	18					
Salta Province	C		2				
Belgian Congo	C	117	98	111	158		
Bolivia	C			28	4	5	25
China: Manchuria—Harbin	C					3	
Chosen	C		2	1	41	58	
Dahomey	C		11			5	
Eritrea (see also table above)	C		1				
Finland	C		1	1	1		
France	C	10				1	
Guatemala	C	1	4	5	2		
Indochina (see also table above)	C	159	219	306	382	505	316
	D	33	38	84	70	97	46
Mexico (see also table above):							
Aguascalientes State—Aguascalientes	C			1	1		

Place		November 1936	December 1936	January 1937	February 1937	March 1937	April 1937
Mexico—Continued.							
Colima State	C				2		
Jalisco State—Guadalajara	C			1	1		
Mexico, D. F.	C			12			
Mexico City	D	1	2	5	2		
Morelos State	C			4			
Nayarit State	C			1			
Nuevo Leon State—Monterrey	C				6		
Puebla State—Puebla	C			1			
San Luis Potosi State—San Luis Potosi	C			1	1		
Morocco	C		2	6	6		
Nyasaland	C	5					
Palestine	C			2	8		
Peru	C	13					
Portugal (see also table above)	C	126	162	113	59	27	
	D	5	8	3	6	2	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths; P, present]

Place		Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Week ended—															
					February 1937				March 1937				April 1937				May 1937			
					6	13	20	27	6	13	20	27	3	10	17	24	1	8	15	22
Algeria:																				
Algiers Department	C	4	19	71	------	[1] 68	40	20	5	41	14	24	16	19	35	26	17	14	30	------
Algiers	C	4	1	1	------	[1] 2	------	------	1	1	------	1	2	------	2	------	1	------	1	------
Constantine Department	C	36	98	159	------	[1] 98	9	32	36	50	66	73	64	128	70	86	98	47	92	------
Bone	C	1	------	2	------	[1] 10	------	------	------	------	3	------	------	------	2	2	1	------	------	------
Constantine	C	3	3	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Philippeville	C	------	1	6	------	------	------	------	------	------	1	------	------	------	------	------	1	------	------	------
Oran Department	C	------	------	10	------	------	12	52	67	------	5	------	------	2	2	20	1	3	------	------
Southern Territories	C	------	------	5	------	3	6	------	2	------	------	------	------	------	1	------	------	------	------	------
Arabia: Aden	C	------	------	------	------	------	------	------	[3] 1	------	------	------	------	------	------	------	------	------	------	------
Australia: Sydney	C	1	------	------	------	------	------	------	------	------	------	1	------	------	------	------	------	------	------	------
Bolivia. (See table below.)																				
Bulgaria. (See table below.)																				
Chile	C	435	385	401	60	60	39	67	53	------	------	------	------	[3] 214	------	------	------	------	------	------
Concepcion Province	C	------	------	------	6	5	5	2	3	------	------	------	------	[3] 17	------	------	------	------	------	------
Santiago Province	C	[1] 87	242	------	25	48	21	36	25	------	------	------	------	[3] 43	------	------	------	------	------	------
Valparaiso	C	12	21	10	2	1	3	4	11	11	10	5	9	14	9	7	2	17	13	28
China (see also table below):																				
Dairen	C	1	4	1	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hankow	C	------	------	2	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Shanghai	C	------	------	------	------	------	------	------	1	------	------	------	------	------	------	------	------	------	------	------
Swatow	C	------	------	------	------	------	1	------	------	------	------	------	------	------	------	------	------	------	------	------
Tientsin	C	------	------	1	------	------	------	1	1	------	------	------	------	------	1	------	------	------	------	------
Tsingtao	C	------	3	------	------	------	1	1	------	------	------	------	------	------	------	1	------	------	------	------
Chosen. (See table below.)																				
Czechoslovakia. (See table below.)																				
Egypt:																				
Alexandria	C	------	1	10	1	5	3	------	1	2	1	1	1	------	1	3	4	4	5	3
Aswan Province	C	------	------	------	------	------	------	------	1	6	------	------	------	------	3	2	4	------	------	------
Asyut Province	C	------	------	------	1	------	1	------	------	5	------	------	------	------	------	------	------	------	------	------
Beheira Province	C	------	------	8	24	7	29	------	2	16	------	------	------	------	20	33	24	------	27	------
Cairo	C	1	------	------	------	------	1	3	2	5	3	1	3	1	6	4	4	4	6	2
Dakahilya Province	C	------	------	------	5	4	16	------	7	8	------	------	------	------	12	26	24	------	35	------
Falyum Province	C	------	1	1	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Gharbiya Province	C	------	3	5	8	3	9	------	8	4	------	------	------	------	19	40	40	------	56	------

Girga Province	C		2																	
Minufiya Province	C			1	5	4	11			6					1	10	6		10	
Minya Province	C			1	19	1	1												1	
Port Said	C		2	8	1															
Qena Province	C			1											4	10	26		6	
Sharkiya Province	C			1					1							2	10			
Provinces	C	15	14	114	62	19	69	25	19	50	35	19	24	36	60	123	144	170	150	149
Eritrea: Asmara	C			14		1								2	2	2	3			
France. (See table below.)																				
Greece (see also table below): Salonika	C	4	4	1																
Guatemala. (See table below.)																				
Hawaii Territory: Honolulu	C	7	2	5							1		1							
Hungary	C						7				1	11								1
Iran	C	2	4	7		14	4	1		1	9	1		6	1			4		
Teheran	C		1	2			3											1		
Iraq:																				
Baghdad	C			1									[1] 5							
Diwaniyeh Province	C																	6		
Kirkuk Province	C											12				8		2		
Kut Province	C													1						
Irish Free State: Kerry County—Cahercivcen	C							4					4							
Italy: Catania	C	1																		
Latvia. (See table below.)																				
Lithuania. (See table below.)																				
Mexico (see also table below):																				
Mexico, D. F.	C	7	4	12	2	8	8	2												
San Luis Potosi	D	1	1	2																
Torreon	C													1						
Morocco (see also table below)	C		1	5	6	6	3	7	5	7	7	5	30	28	23	39	69	65	70	47
Palestine:																				
Haifa	C	7	11	3		1			1					1			1	1		2
Jaffa	C	7	8	2					1	1			2	1		1	1		2	1
Peru. (See table below.)																				
Poland	C	131	175	399	88	88	146	163	101	140	100	121	161	169	136	163	158	132	205	
	D	6	13	22	6	5	7	8	7	7	13	6	9	12	7	12	9	11	10	
Rumania. (See table below.)																				
Sierra Leone: Freetown	C	1		1		1														
Straits Settlements: Singapore	C			1																
Sudan (Anglo-Egyptian)	C		[2] 8																	
Syria	C													1						
Trans-Jordan	C						3		1					1	2		3			
Tunisia:																				
Tunis	C	3		7	2	3			2		1	1		1	3		2	3	9	1
Provinces	C	43	54	214	50		94	103	138	119	168	125	79	102	133	114	90	166	133	133
Turkey. (See table below.)																				
Union of South Africa. (See table below.)																				
Yugoslavia. (See table below.)																				
On vessel: At Santos	C										P									

[1] For 2 weeks.
[2] Imported.
[3] For 5 weeks.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER—Continued

Place		November 1936	December 1936	January 1937	February 1937	March 1937	April 1937
Bolivia	C			24	25	30	48
Bulgaria	C		19	19			
China: Manchuria—Harbin	C	1	7	8	35	58	
Chosen	C	30	28	88	149	154	
Czechoslovakia	C		3	15	12	33	25
France	C	1	1				
Greece (see also table above)	C	11	2	7	2	4	
Guatemala	C	33	28	29	19	4	13
Latvia	C					1	1
Lithuania	C	2	3	13	10	23	
Mexico (see also table above):							
Aguascalientes State: Aguascalientes	C			2	3		
Mexico State	C			8			
	D			1			
Mexico, D. F.	C			14	18		
Mexico City	D	2	5	6	6		
Mexico—Continued							
Oaxaca State	C					2	
Puebla State: Puebla	C		9	7	3		
Queretaro State	C			1	2		
San Luis Potosi State: San Luis Potosi	C	5	7	7			
Morocco (see also table above)	C	1	2	11	22	27	
Peru	C	60	52				
Rumania	C	178	380	941	1,018	917	
Turkey	C	18	21	24	50	68	39
Istanbul	C	4	1	7	3		3
Union of South Africa:							
Cape Province	C	74	61	52	12	38	
Natal	C	19	4	4	1	1	
Orange Free State	C	9	8	5	11	5	
Transvaal	C	11	6	13	1	2	
Yugoslavia	C	7	49	159	125		

YELLOW FEVER

[C indicates cases; D, deaths; P, present]

Place		Nov. 1–28, 1936	Nov. 29–Dec. 26, 1936	Dec. 27, 1936–Jan. 30, 1937	Week ended— February 1937				March 1937				April 1937				May 1937				
					6	13	20	27	6	13	20	27	3	10	17	24	1	8	15	22	29
Brazil: [1]																					
Acre Territory	D			1	1																
Matto Grosso State [1]	C		1		2	13	4	1	1												
	D			3	1	2	2	1			1	2					2	1			
Minas Geraes State [1]	C			1	1	1															
	D			1	1	2	4	6	9	5	12	8	3	6	2	1					
Paraná State	C						2														
São Paulo State [1]	C			4		1															
	D			4		1	2	11	9	4	5	[2] 17	1								

Colombia	C		3																		
	D		1																		
Barrancabermeja	C				1																
Intendencia of Meta—																					
Acacias	D	1																			
Villavicencio	D	1																			
Dahomey	C	1																			
French Equatorial Africa:																					
Brazzaville	D															1					
Libreville	C										1										
	D					1															
Gold Coast:																					
Aburi	C																	1			
Accra	C			5	1	2															
Apesi [1]	C																				1
Nugo	C																				1
Tamale	C		1																		
Teshi	C			1							1							1			
Ivory Coast:																					
Adzope	C						3														
Agboville	C										1										
Nigeria:																					
Calabar	C	1																			
Maiduguri	D	1																			
Uyo	C		1																		
Peru: Perene region (Pampa Whaley)	C												[4] 10	[4] 13							
	D												5	3							
Senegal:																					
Bambey	C	1																			
Dakar	C																	[5] 1			
Diakhao	C										1						1				
Fatick.[6]																					
Malem Hodar	C																				1
M'Bour	C	[5] 1																			
Thies Circle:																					
Khombole	C	1												1							
Thies	C	[5] 1																			
Tilmaka	C													1						1	
Tivaouane	C													1							
Sudan (French): Mahina	C																	[5] 1			

[1] See also reports of yellow fever in Brazil on pp. 463, 536, 657, 683, 762, and 818, of the PUBLIC HEALTH REPORTS.
[2] For 3 weeks.
[3] During the week ended June 12, 1937, 2 cases of yellow fever with 1 death were reported in Apesi, Gold Coast.
[4] Jungle type.
[5] Suspected.
[6] The case of yellow fever reported in Fatick, Senegal, on p. 722 of PUBLIC HEALTH REPORTS of May 28, 1937, has not been confirmed.